DRAKE

INSTRUCTION MANUAL

MODEL **TR-4C**

SIDEBAND TRANSCEIVER

R. L. DRAKE COMPANY, MIAMISBURG, OHIO, U.S.A.

LIMITED WARRANTY

R. L. DRAKE COMPANY warrants to the original purchaser that this product shall be free from defects in material (except tubes and RF output transistors) or workmanship for ninety (90) days from the date of original purchase.

During the warranty period the R. L. DRAKE COMPANY or an authorized Drake service facility will provide free of charge both parts (except tubes and RF output transistors) and labor necessary to correct defects in material or workmanship.

To obtain such warranty service, the original purchaser must:

(1) Complete and send in the Warranty Registration Card.

(2) Notify R. L. DRAKE COMPANY or its nearest authorized service facility, as soon as possible after discovery of a possible defect, of:

(a) The model number and serial number, if any;

(b) The identity of the seller and the approximate date of purchase;

(c) A detailed description of the problem, including details on the electrical connection to associated equipment and the list of such equipment.

(3) Deliver the product to the R. L. DRAKE COMPANY or the nearest authorized service facility, or ship the same in its original container or equivalent, fully insured and shipping charges prepaid.

Correct maintenance, repair and use are important to obtain proper performance from this product. Therefore, carefully read the Instruction Manual. This warranty does not apply to any defect that R. L. DRAKE COMPANY determines is due to:

(1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts.

(2) Misuse, abuse, neglect or improper installation.

(3) Accidental or intentional damage.

All implied warranties, if any, terminate ninety (90) days from the date of the original purchase.

The foregoing constitutes R. L. DRAKE COMPANY'S entire obligation with respect to this product, and the original purchaser and any user or owner shall have no other remedy and no claim for incidental or consequential damages. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you.

This warranty gives specific legal rights and you may also have other rights which vary from state to state.

R. L. DRAKE COMPANY
540 Richard Street • Miamisburg, Ohio 45342

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TABLE OF CONTENTS

		Page
CHAPTER I	INTRODUCTION	1–1
1–1.	GENERAL DESCRIPTION	1–1
1–2.	MANUAL COVERAGE	1–1
	SPECIFICATIONS	1–3
CHAPTER II	INSTALLATION	2–1
2–1.	UNPACKING	2–1
2–2.	LOCATION	2–1
2–3.	MOBILE INSTALLATION	2–1
2–4.	POWER REQUIREMENTS	2–1
2–5.	MOUNTING	2–1
2–6.	ANTENNA	2–1
2–7.	SPEAKER	2–1
2–8.	MICROPHONE	2–1
2–9.	STATIONARY INSTALLATION	2–2
2–10.	POWER REQUIREMENTS	2–2
2–11.	VIEWING ANGLE	2–2
2–12.	ACCESSORIES	2–2
CHAPTER III	OPERATION	3–1
3–1.	GENERAL	3–1
3–2.	MODE SWITCH	3–1
3–3.	BLANKER SWITCH	3–1
3–4.	VFO DIAL	3–1
3–5.	TUNING PROCEDURE	3–1
3–6.	BIAS ADJUSTMENT	3–1
	FRONT PANEL CONTROLS	3–3
	OTHER CONTROLS	3–4
3–7.	TUNE UP	3–5
3–8.	SSB OPERATION	3–5

TABLE OF CONTENTS (continued)

		Page
3–9.	CW OPERATION	3–6
3–10.	AM OPERATION	3–6
3–11.	OPERATION NEAR BAND EDGES	3–6
3–12.	OPERATION WITH A LINEAR AMPLIFIER	3–6
3–13.	NOVICE OPERATION	3–7
CHAPTER IV	THEORY OF OPERATION	4–1
4–1.	GENERAL	4–1
4–2.	RECEIVER CIRCUITRY	4–1
4–3.	TRANSMITTER CIRCUITRY	4–2
CHAPTER V	MAINTENANCE	5–1
5–1.	SERVICE DATA	5–1
5–2.	TOP COVER REMOVAL	5–1
5–3.	BOTTOM COVER REMOVAL	5–1
5–4.	TUBE REPLACEMENT	5–1
5–5.	TROUBLE SHOOTING	5–1
5–6.	TEST EQUIPMENT	5–2
5–7.	ALIGNMENT PROCEDURES	5–2
5–8.	CRYSTAL CALIBRATOR	5–2
5–9.	9.0 MHz OSCILLATOR	5–2
5–10.	INJECTION CRYSTAL OSCILLATOR	5–2
5–11.	VFO ADJUSTMENT	5–2
5–12.	INJECTION COUPLER	5–2
5–13.	RECEIVER IF	5–5
5–14.	BALANCED MODULATOR AND CARRIER BALANCE	5–5
5–15.	FILTER MATCHING TRANSFORMER	5–6
5–16.	MIXER AND IF ALIGNMENT	5–6
5–17.	PA NEUTRALIZATION	5–6
5–18.	TRANSMITTER NEUTRALIZATION	5–6
5–19.	S METER ADJUSTMENT	5–6

LIST OF ILLUSTRATIONS

Figure		Page
1–1.	TR–4C SIDEBAND TRANSCEIVER	1–2
2–1.	MICROPHONE CONNECTIONS	2–1
2–2.	REAR CHASSIS CONNECTORS	2–2
2–3.	ELECTRICAL CONNECTIONS REQUIRED FOR MOBILE INSTALLATION	2–3
2–4.	MOBILE INSTALLATION MOUNTING OPTIONS	2–4
2–5.	VIEWING ANGLE OPTIONS IN A STATIONARY INSTALLATION	2–5
2–6.	CONNECTING THE AC–4 POWER SUPPLY AND MS–4 SPEAKER	2–5
2–7.	CONNECTING THE AC–4 POWER SUPPLY, RV–4C REMOTE VFO AND A LINEAR AMPLIFIER	2–6
2–8.	CONNECTING THE AC–4 POWER SUPPLY AND THE L–4B LINEAR AMPLIFIER	2–6
2–9.	CONNECTING AN EXTERNAL RECEIVER	2–7
3–1.	FRONT PANEL CONTROLS	3–2
4–1.	BLOCK DIAGRAM	4–4
5–1.	ALIGNMENT LOCATIONS, TOP VIEW	5–8
5–2.	ALIGNMENT LOCATIONS, BOTTOM VIEW	5–9
5–3.	AC–4 POWER SUPPLY SCHEMATIC	5–11
5–4.	DC–4 POWER SUPPLY SCHEMATIC	5–11
5–5.	TR–4C SCHEMATIC	5–11

CHAPTER I
INTRODUCTION

1-1. GENERAL DESCRIPTION.

The TR–4C is a 300 Watt HF single sideband transceiver which covers the 80 through 10 meter amateur bands. AM and CW modes are also included. The TR–4C requires either an R. L. Drake AC–4, 120 V AC power supply, or an R. L. Drake DC–4, 12 V DC power supply. The TR–4C features a high-stability linear permeability tuned VFO and two 8 pole crystal lattice filters for sideband selection. Available accessories include an RV–4C Remote VFO, a matching MS–4 Speaker, an FF–1 Fixed Frequency Adapter, a 34–PNB Noise Blanker, an MC–4 Mobile Console, and a TR–4C VHF Modification Kit.

1-2. MANUAL COVERAGE.

This manual provides sufficient information for operation of the TR–4C Transceiver by a licensed operator and for repair and maintenance by an experienced electronics technician. Chapter II provides installation instructions and illustrates interconnection with accessories. Chapter III describes operation procedures. Chapter IV presents theory of operation supported by a block diagram. Chapter V provides maintenance instructions and parts ordering information.

Figure 1–1. TR–4C Sideband Transceiver

SPECIFICATIONS

GENERAL:	
Frequency Coverage:	3.5 to 4.1 MHz, 7.0 to 7.6 MHz, 13.9 to 14.5 MHz, 21.0 to 21.6 MHz and 28.5 to 29.1 MHz; accessory crystals are available for the 28.0 to 28.6 MHz and 29.1 to 29.7 MHz segments of the 10 meter band.
Mode of Operation:	Lower Sideband, Upper Sideband, AM and CW.
Frequency Stability:	Total drift is less than 100 Hz after warm up. Total frequency change is less than 100 Hz for a ± 10% line voltage change.
Power Supply Requirements:	+ 650 Volts DC at 300 mA average and 500 mA maximum with 10% regulation from 100 to 500 mA and a maximum ripple 1%. + 250 Volts DC at 200 mA with 10% regulation from 170 mA to 200 mA. This includes the effect of the 650 Volt supply change if both voltages are obtained from the same transformer. Maximum ripple must be less than 1/4%. –45 to –65 Volts DC adjustable filtered bias into 33 K Ohm load. 12.6 Volts AC or DC at 5.5 Amperes.
Antenna Impedance:	Nominal 52 Ohms (VSWR less than 2:1).
Dial Calibration:	Better than ± 1 kHz when calibrated at the nearest 100 kHz calibration point.
Dimensions:	5.5 in. High x 10.75 in. Wide x 14.375 in. Deep. 13.97 cm. High x 27.31 cm. Wide x 36.51 cm. Deep.
Weight:	16 lbs. (7.26 kg.)
RECEIVER:	
Sensitivity:	Less than 0.5 uV for 10 dB $\frac{S+N}{N}$
AGC:	Less than 3 dB variation for 60 dB change in input signal.
Selectivity:	2.1 kHz at –6 dB and 3.4 kHz at –60 dB.
IF Frequency:	9 MHz.
Audio Output:	3 Watts with less than 10% distortion.
Output Impedance:	4 Ohms.
TRANSMITTER:	
Power Input:	300 Watts PEP SSB, 260 Watts CW and 260 Watts PEP AM.
Output Impedance:	Nominal 52 Ohms.
Average Distortion Products:	The odd order products are down 30 dB below PEP.
Microphone Input:	High Impedance.

NOTES

CHAPTER II
INSTALLATION

2-1. UNPACKING.

Carefully remove the unit from the shipping carton and examine it for evidence of damage. If any damage is discovered, immediately notify the transportation company that delivered the unit. Be sure to keep the shipping carton and packing material as the transportation company will want to examine them if there is a damage claim. Keep the carton and packing material even if no shipping damage occurs. Having the original carton available makes packing the unit much easier if it should ever be necessary to store it or return it to the factory for service.

NOTE

Fill out the enclosed registration card and return it to the factory immediately to insure registration and validation of the warranty.

2-2. LOCATION.

The location of the TR–4C is not critical. However, care should be taken to insure that adequate clearance is provided to insure free circulation of air around the unit and to allow access to the side controls and connectors. Do not cover the top of the cabinet with books, papers or other equipment as overheating may result.

2-3. MOBILE INSTALLATION.

2-4. POWER REQUIREMENTS. Refer to figure 2-2 for rear chassis connector identification. The TR–4C may be installed in any vehicle with a 12 volt dc negative ground system. An R. L. Drake Model DC–4 Power Supply is required for a mobile installation. The recommended location for the DC–4 is on the passenger side of the firewall. Refer to figure 2-3 for the electrical connections required.

2-5. MOUNTING. Mount the TR–4C in a convenient location below the dash with an R. L. Drake Model MMK–3 Mobile Mounting Kit. Refer to figure 2-4 for various mounting options. Be sure to allow adequate clearance for air circulation and cable connections. Turn the TR–4C off. Connect the power cable between the TR–4C and the DC–4. Coil up any excess cable and tape it in place out of sight. Connect the black wire from the power supply to a convenient ground. Route the red wire from the power supply through the firewall and connect it to the positive battery terminal or the starter solenoid. The fuse holder should be installed as close to the solenoid as possible. Shorten both of these wires as much as possible.

2-6. ANTENNA. Install a mobile antenna as recommended by the antenna manufacturer. Connect a coaxial cable from the antenna to the SO–239 connector at the rear of the TR–4C.

2-7. SPEAKER. *DO NOT* connect the TR–4C to the speaker of the car radio. Install a separate speaker for use with the TR–4C. The R. L. Drake Model MC–4 Mobile Console is recommended for this type of installation. It includes a speaker and a wattmeter and is designed to mount over or under the TR–4C.

2-8. MICROPHONE. Use a microphone with a flat frequency response. The microphone should have a cardioid pattern to reduce pickup from the back and sides. Connect the microphone as illustrated in figure 2-1 to insure proper performance.

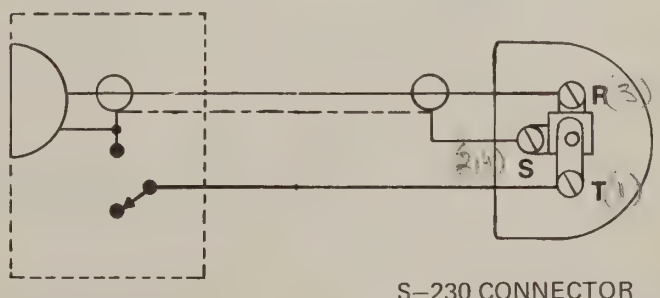


Figure 2–1. Microphone Connections

2-9. STATIONARY INSTALLATION.

2-10. POWER REQUIREMENTS. An R. L. Drake Model AC–4 Power Supply rated at 120 volts ac, 50/60 Hz, is required for stationary installations. The AC–4 is designed to fit inside the MS–4 speaker cabinet.

2-11. VIEWING ANGLE. Refer to figure 2-5 for illustrations of viewing angle options. See Chapter V for bottom cover removal.

2-12. ACCESSORIES. Refer to figures 2-6 through 2-9 for the electrical connections required to operate the TR–4C with the various recommended accessories.

NOTE

If the old RV–3 is to be used it must be modified as follows: Install a 22 K, 2 Watt resistor from pin 1 of the tube (0A2) to the terminal of the FUNCTION switch to which the orange wire is attached.

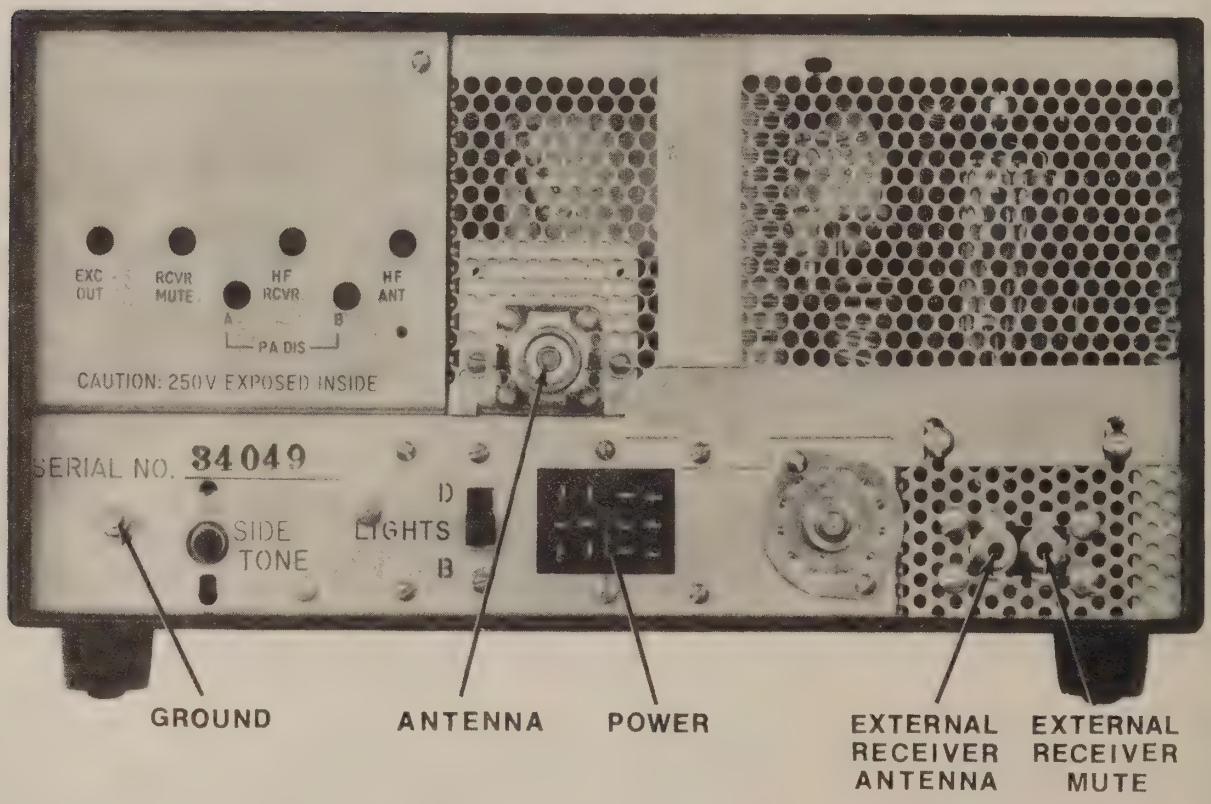


Figure 2–2. Rear Chassis Connectors

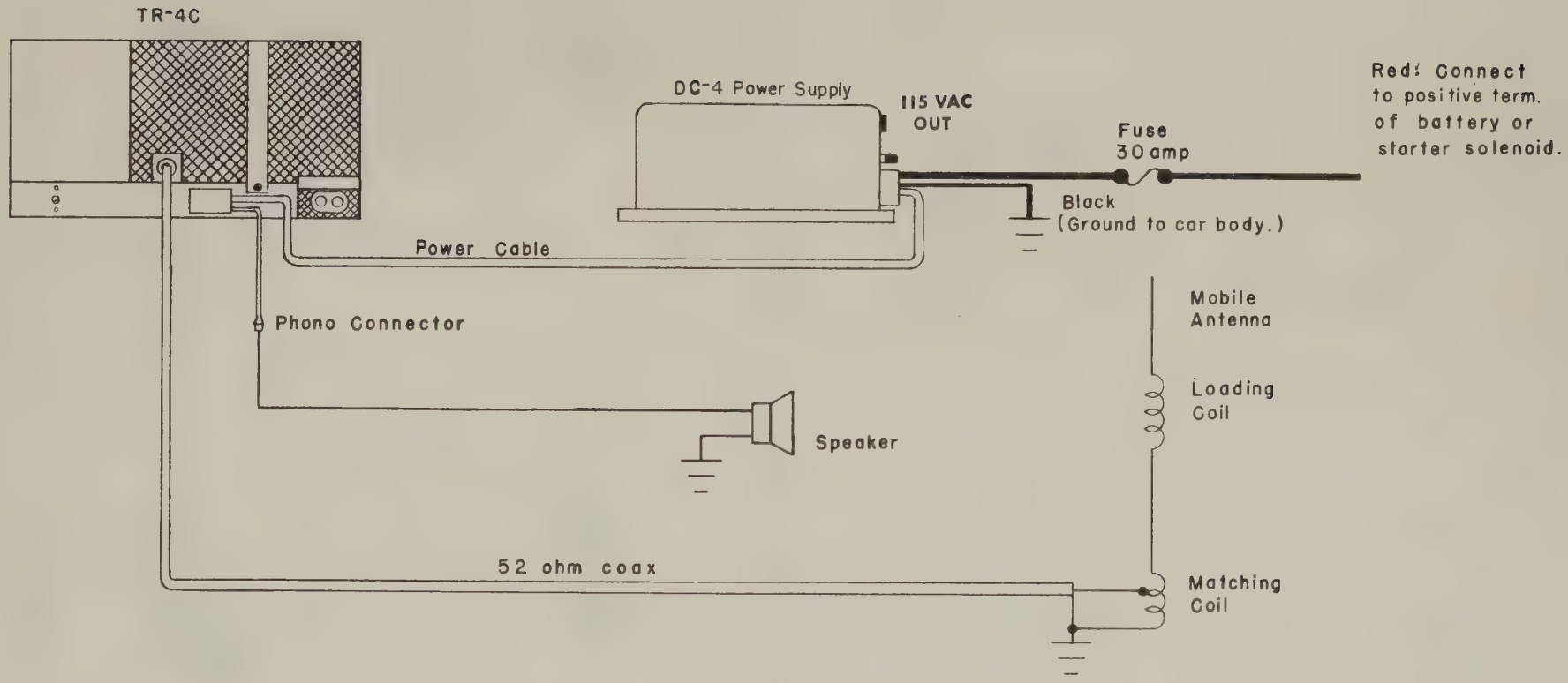
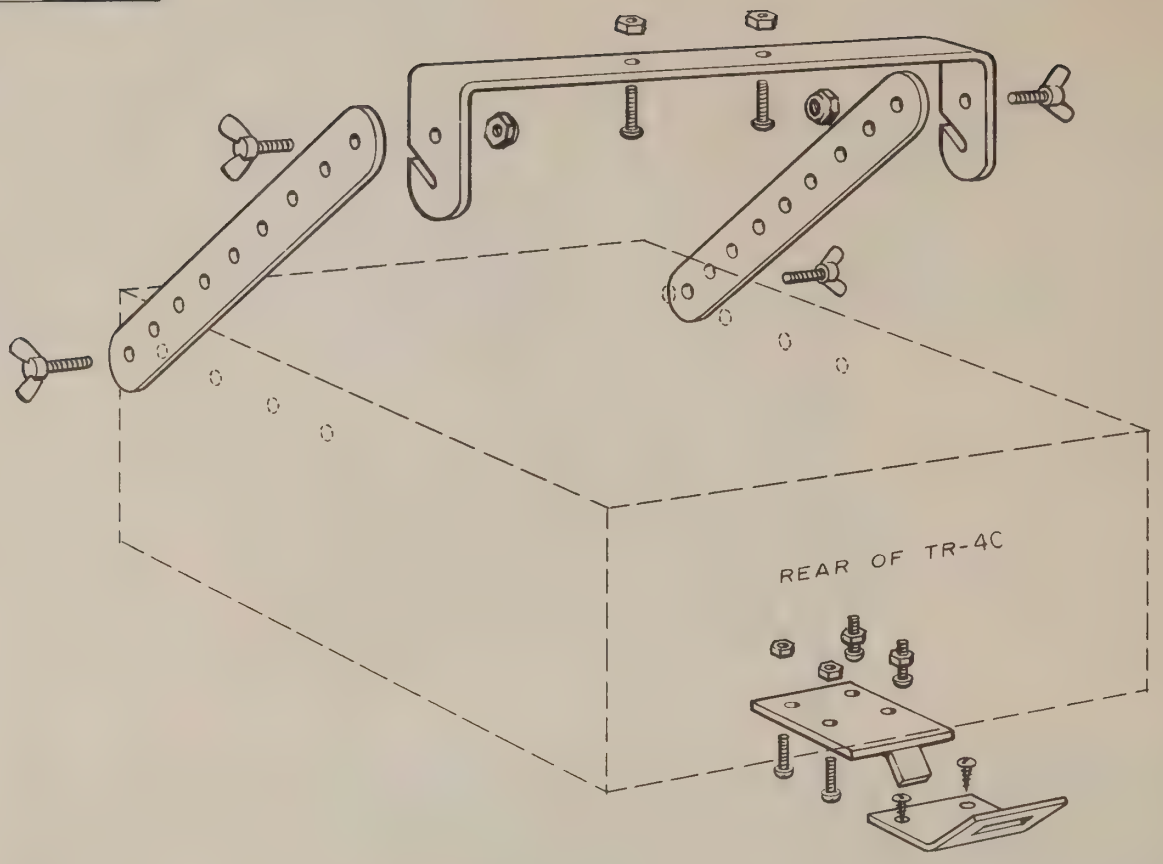


Figure 2–3. Electrical Connections Required for Mobile Installation



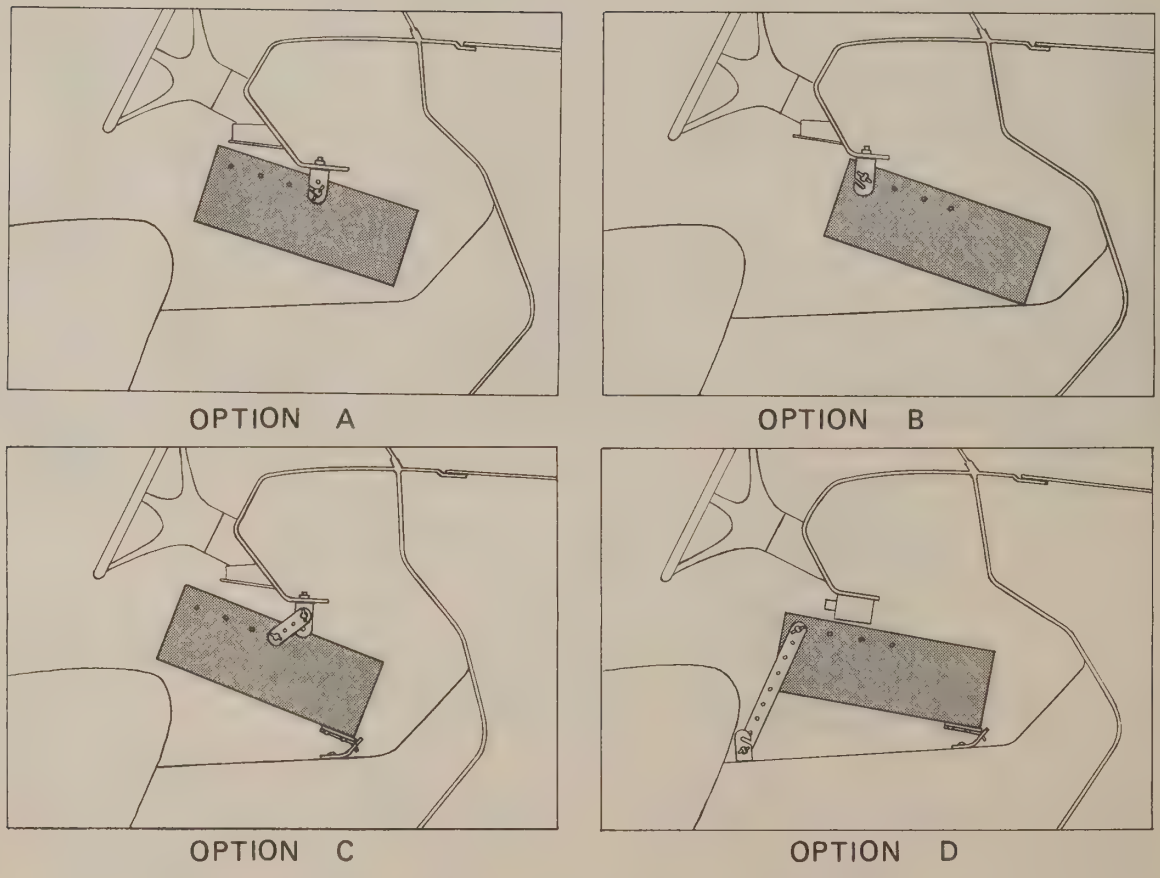


Figure 2–4. Mobile Installation Mounting Options

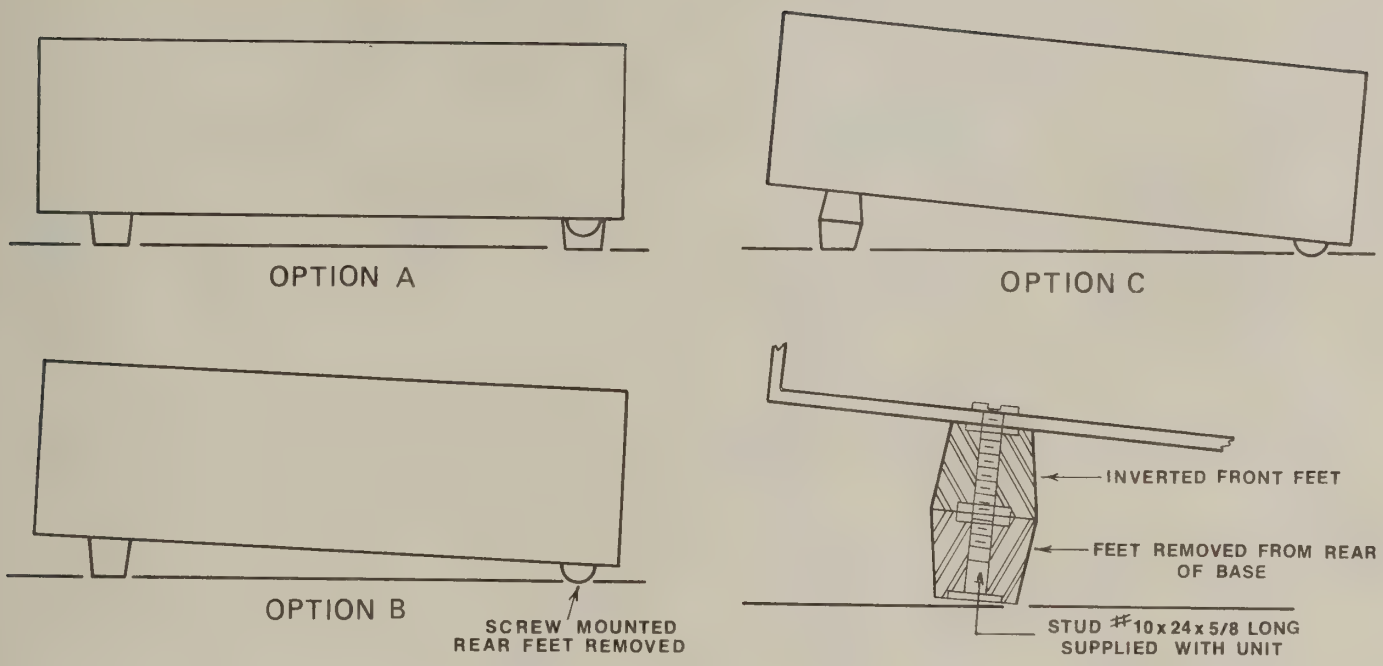


Figure 2–5. Viewing Angle Options in a Stationary Installation

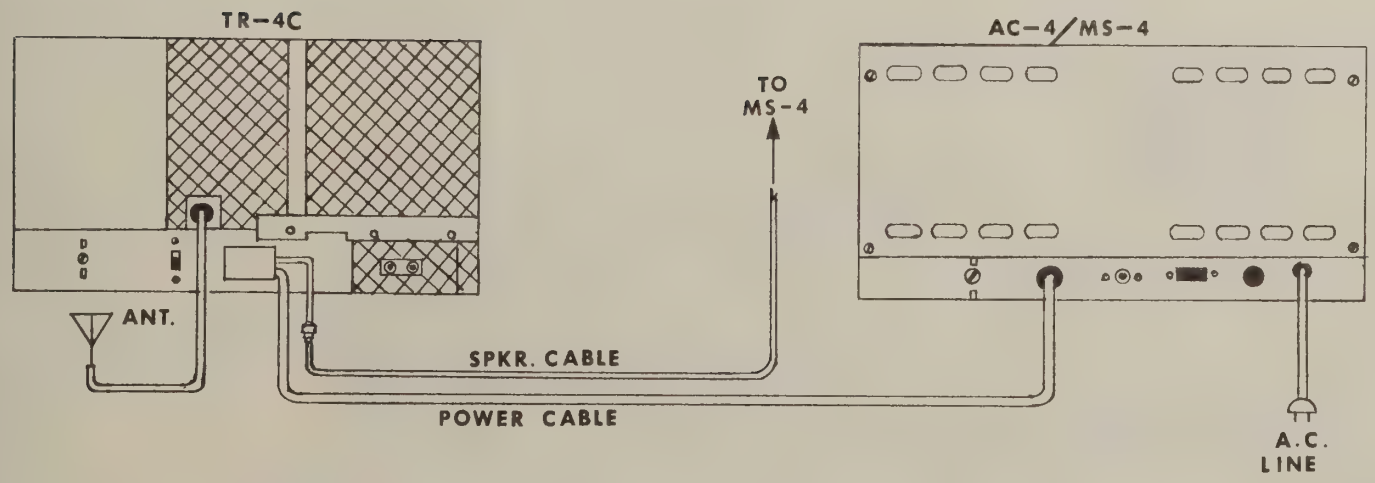


Figure 2–6. Connecting the AC–4 Power Supply and MS–4 Speaker

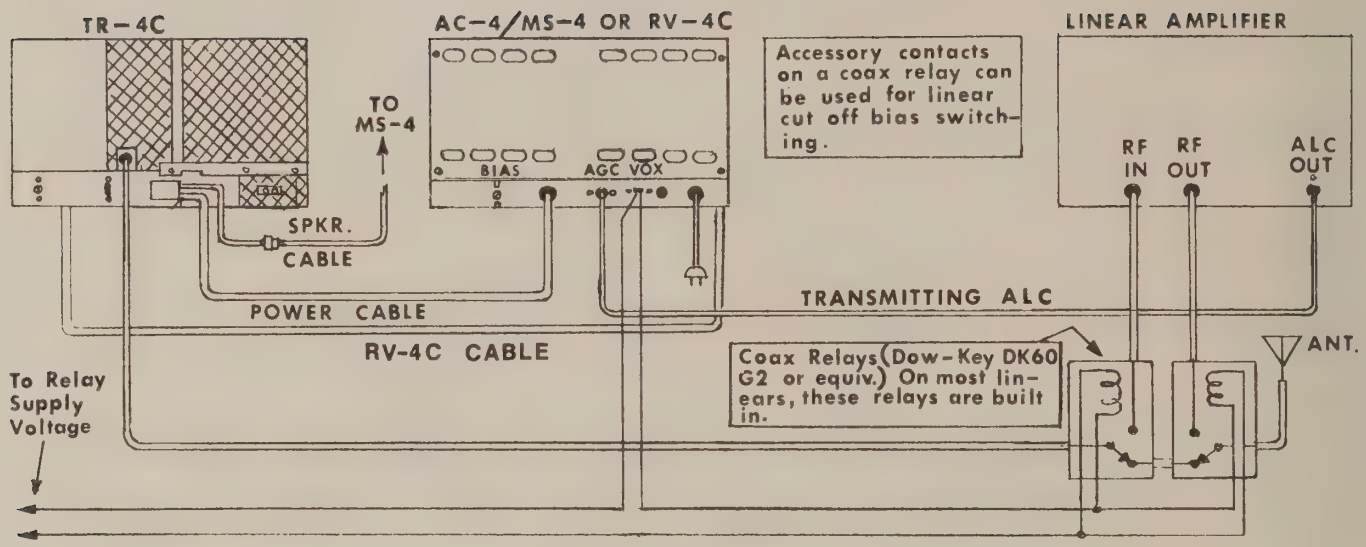


Figure 2–7. Connecting the AC–4 Power Supply, RV–4C Remote VFO and a Linear Amplifier

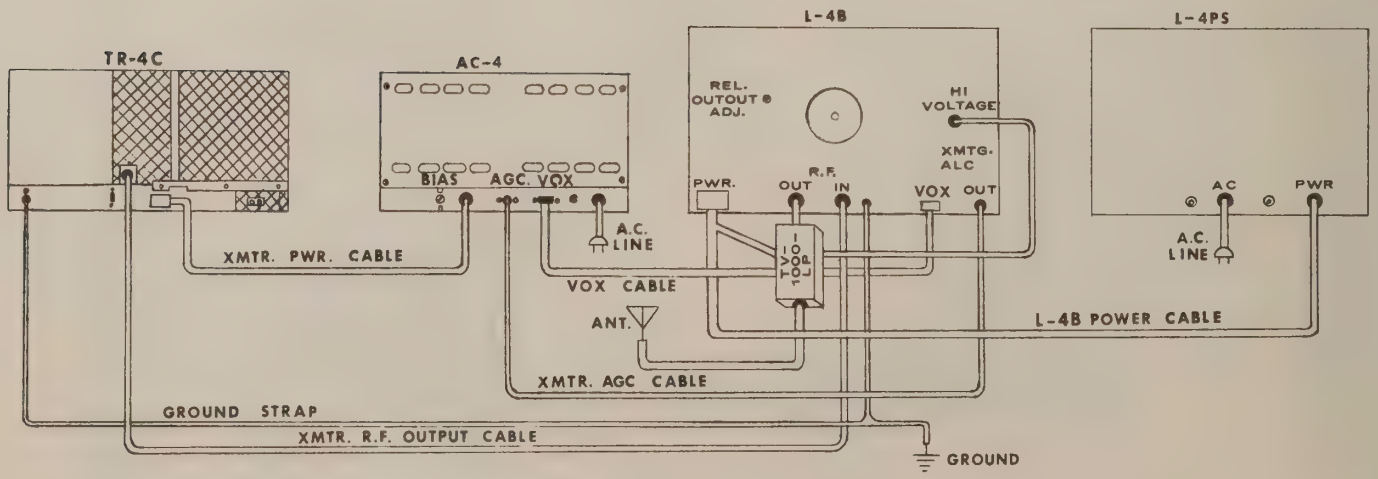


Figure 2–8. Connecting the AC–4 Power Supply and the L–4B Linear Amplifier

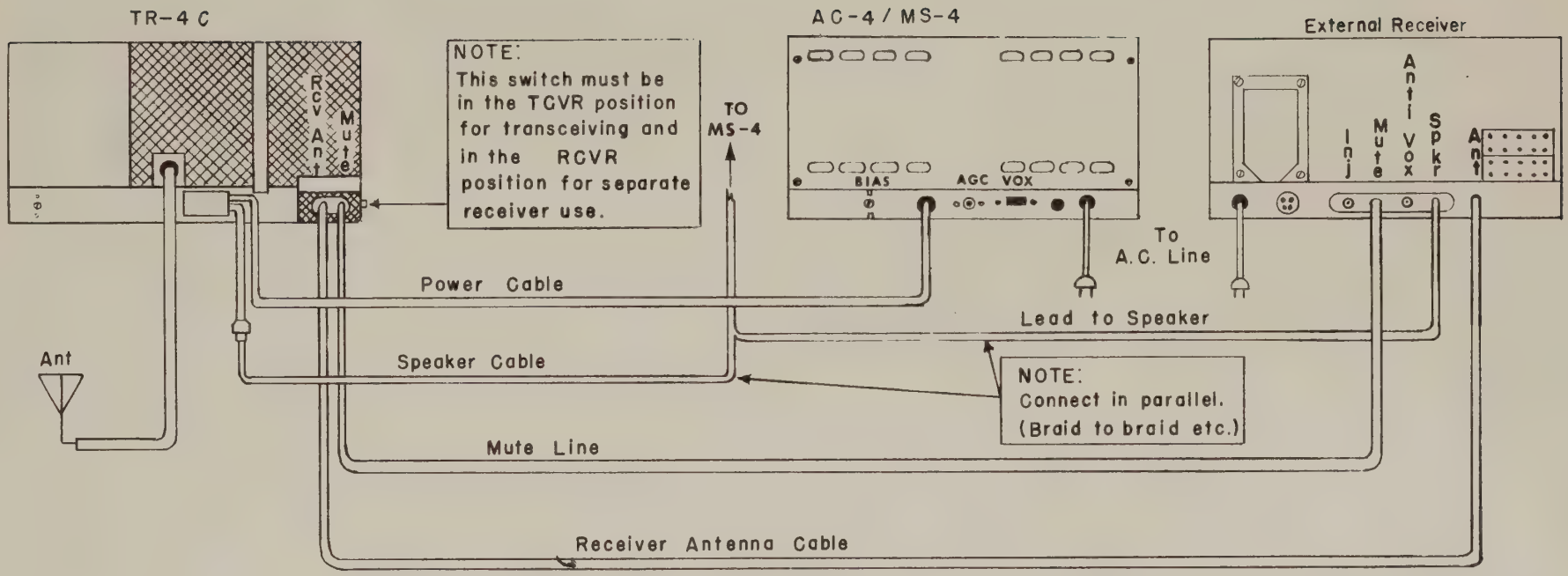


Figure 2–9. Connecting an External Receiver

NOTES

CHAPTER III
OPERATION

3-1. GENERAL.

Figure 3-1 illustrates and describes all front panel controls and indicators on the TR–4C Transceiver. Controls and connectors located on the rear and sides of the unit are described under "other controls" below. Rear chassis connectors are identified in figure 2-2.

3-2. MODE SWITCH. In the SSB position, the receiver portion functions until the transmitter is energized either by talking into the microphone or actuating the microphone push-to-talk switch. The transmitter then emits an upper or lower sideband signal depending on the setting of the SIDEBAND switch. In the X-CW position, the receiver portion functions until the key is closed. The TR–4C then goes into the transmit mode, a CW sidetone is energized and the carrier is shifted approximately 1 kHz from the received frequency. The unit will remain in transmit during CW keying and will return to receive when keying is stopped briefly. NOTE: The SIDEBAND switch must be in the X position when the Mode switch is on X-CW or X-AM. It should also be noted that if the relays fail to close occasionally when the key is used, advance the VOX gain (screwdriver adjust on the right side of the chassis) until positive relay action is obtained. In the X-AM position, a controlled carrier screen modulator is incorporated for AM transmission and a diode detector is used for AM reception. Transmit and receive switching is accomplished by VOX or push-to-talk as on SSB.

3-3. BLANKER SWITCH. The noise blanker may be left on except when there is a strong signal within 5 kHz of the received signal. A strong signal which falls within the 10 kHz wide crystal filter in the noise blanker, and outside the 2.1 kHz crystal filter in the TR–4C, will operate the noise blanker gate circuit causing distortion products. This limitation in the noise blanker is caused by the necessity of having a bandwidth in the blanker wide enough to minimize stretching of noise pulses before blanking. Usually this limitation is no problem under normal operating conditions.

3-4. VFO DIAL. This dial consists of 2 transparent discs which display concentric scales and which rotate at different speeds. There are 2 scales on each disc. The upper scale on each disc is used for all bands except 20 meters where the lower scale is used. Zero to 100 kHz is indicated on one disc and hundreds of kHz is indicated on the other. The frequency of the operating signal is the sum of the frequencies indicated by the BAND switch and the VFO dial, for example:

BAND switch frequency	7.000 MHz
100 kHz dial	.200
1 kHz dial	.072
Operating frequency	7.272 MHz

This dial may be calibrated over a short range by the following procedure:

a. Set the Mode switch to CAL.
b. Tune the TR–4C to zero beat with the nearest 100 kHz calibrator signal.
c. Hold the tuning knob stationary and rotate the knob skirt until the dial displays the correct frequency.

3-5. TUNING PROCEDURE.

CAUTION

Under no circumstances should operation of the TR–4C be attempted until it is connected to a proper antenna or a dummy load. Always allow a two minute warm up period after the TR–4C is turned on before transmitting.

3-6. BIAS ADJUSTMENT. Before any type of operation is attempted, it will be necessary to set the PA bias to the correct value. Proceed as follows:

a. Turn on the TR–4C with the RCVR GAIN control.
b. Rotate the XMTR GAIN control fully counterclockwise.

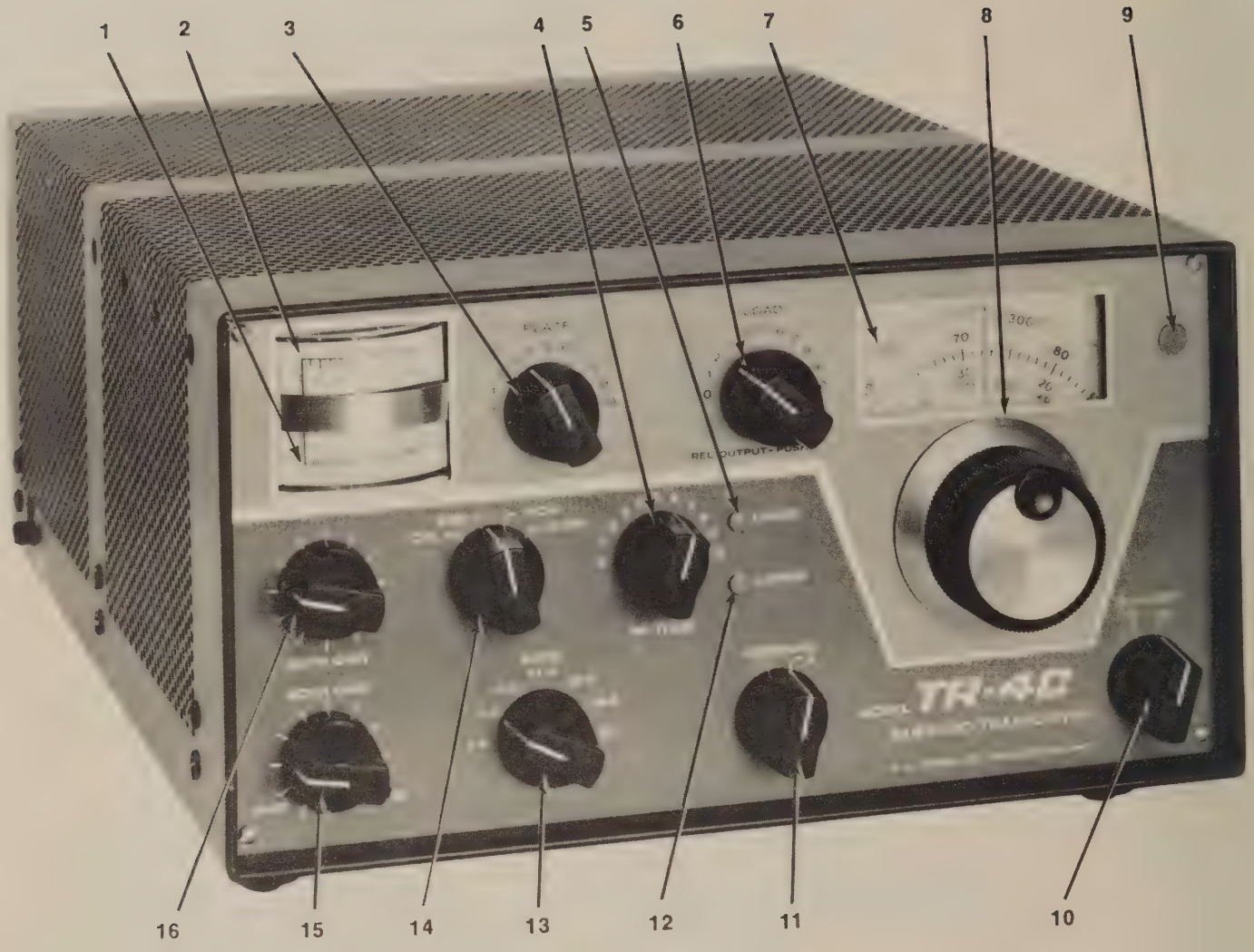


Figure 3–1. Front Panel Controls

FRONT PANEL CONTROLS

1. S meter: Indicates relative level of received signals. Indicates transmitter AGC when transmitting.
2. Plate meter: Indicates plate current in the final amplifier. Indicates relative RF power when LOAD control (6) is pushed in.
3. PLATE control: Tunes power amplifier pi-network circuit for resonance.
4. RF TUNE control: Peak tunes the receiver RF amplifier, the transmitter driver grid and plate tuned circuits.
5. UPPER sideband indicator lamp: Glows when upper sideband is selected.
6. LOAD control: Matches the TR–4C to the impedance of the antenna. Push in to display relative RF power on plate meter (2).
7. VFO dial: Displays portion of operating frequency from zero to 600 kHz. Reading must be added to BAND switch frequency setting for complete operating frequency.
8. VFO control: Adjusts frequency setting of dial (7).
9. VFO indicator lamp: Glows only when TR–4C VFO is operating.
10. BLANKER switch: Provides on/off control for R. L. Drake's Model 34–PNB Noise Blanker (an accessory).
11. SIDEBAND switch: Selects upper or lower sideband and lights appropriate indicator lamp (5 or 12).
12. LOWER sideband indicator lamp: Glows when lower sideband is selected.
13. BAND switch: Selects the desired amateur band.
14. Mode switch: Selects the desired mode of operation. In CAL position, it switches on the 100 kHz crystal calibrator (operable in transmit or receiver mode).
15. RCVR GAIN control: Dual control. Knob controls the receiver audio level, and provides a power on/off control at the extreme counter-clockwise position. Lever controls the maximum RF gain of the receiver.
16. XMTR GAIN control: Adjusts the microphone gain on AM and SSB. In CW mode it adjusts the RF drive.

OTHER CONTROLS

Right Side (not illustrated).

PHONE jack: Provides a connection for headphones or external speaker.

MIC jack: Provides a connection for microphone. Mates with connector S-230 furnished with the TR–4C.

VOX control: Adjusts the gain of the VOX amplifier and the antenna relay release time on CW.

ANTIVOX control: Adjusts the gain of the ANTIVOX amplifier.

ZERO control: Adjusts the no-signal display of the S meter to S1.

KEY jack: Provides a connection for CW key. With key connected, transmitter is disabled for all modes of operation and receiver is disabled for AM unless the key is closed.

Left Side (not illustrated).

RCVR/TCVR switch: Selects either the TR–4C Receiver or external receiver.

Rear Chassis (Refer to figure 2-2).

Ground terminal: Provides a connection for earth ground.

SIDE TONE control: Adjusts the level of the CW sidetone with respect to the received signal. For no sidetone, rotate fully counterclockwise.

LIGHTS switch: Changes intensity of dial lamps to dim (D) or bright (B).

Antenna connector: Provides a connection for the station antenna (SO-239).

Power connector: Provides a connection for either AC–4 or DC–4 Power Supply.

External Receiver Antenna jack: Provides a connection for an external receiver.

External Receiver Mute jack: Provides a connection for muting an external receiver. It may be used with any receiver which requires a DC path to ground for receiving and an open circuit for muting. All R. L. Drake receivers have this feature.

NOTE

Rear chassis markings *above* the CAUTION notice identify external cable connectors when TR–4C VHF Modification Kit is used.

c. Turn the SIDEBAND switch to its counterclockwise position.
d. Turn the Mode switch to X-CW.
e. Adjust the Power Supply (AC–4 or DC–4) bias control for a reading of 0.1 Amperes on the plate current meter.

3-7. TUNE UP. Do not allow plate current to exceed 0.1 Amperes for more than 6 seconds with the PLATE control not tuned for minimum plate current or maximum RF output.

CAUTION

Failure to observe the warning above will result in rapid final amplifier tube deterioration due to excessive plate dissipation.

The final amplifier pi-network will match a nominal 50 ohm load. The VSWR may be as high as 2:1 on all bands except 80 meters where a lower VSWR may be required. On 80 meters an external antenna matching network may be required.

Preset the controls as follows:

a. Select the desired band with the BAND switch.
b. Select the desired operating frequency with the VFO tuning knob.
c. Rotate the XMTR GAIN control full counterclockwise.
d. Rotate the LOAD control full counterclockwise.
e. Place the SIDEBAND control in the X position.
f. Place the Mode switch in the SSB position.
g. Peak the RF TUNE control for maximum noise or signal as indicated by the S meter.

Rotate the Mode switch to the X-CW position and advance the XMTR GAIN control until the plate current meter moves up scale slightly. Peak the RF TUNE control for maximum plate current and quickly tune the PLATE control for a dip in plate current. After the dip is found, rotate the XMTR GAIN control clockwise until plate current no longer increases.

Depress the LOAD control and alternately adjust the PLATE and LOAD controls in small increments for maximum RF output. Release the LOAD control and adjust the PLATE control for minimum plate current. At this point the plate meter should indicate a plate current between 0.380 and 0.500 Amperes. The reading will depend on the line voltage, antenna match, tube condition, etc. Increasing the setting of the LOAD control beyond the point at which maximum RF output occurs will result in excessive plate dissipation. It should not be necessary to advance the LOAD control beyond 4.5 to obtain maximum RF output. Further advancement indicates that the VSWR of the antenna system is too high and leaving the control set beyond this point is likely to result in excessive harmonic radiation. The above procedure should be completed as quickly as possible and the Mode switch should be returned to the SSB position.

When the Mode switch is in the X-CW position, the screen voltage on the final amplifier tubes is reduced to prevent overheating. When the switch is in the SSB position, this voltage is increased so that an input power of 300 watts can be obtained.

3-8. SSB OPERATION.

In the following discussion, it is assumed that the TR–4C has already been tuned up on the desired band as described in paragraph 3-7. Preset the controls as follows:

SIDEBAND	–On desired sideband as shown by indicator lights.
Mode	–On SSB.
XMTR GAIN	–Fully counterclockwise.
RF gain (lever)	–Fully clockwise.
RCVR GAIN (knob)	–Fully counterclockwise (do not turn off power).
VOX gain	–Fully clockwise.
ANTIVOX	–Fully counterclockwise.

While talking into the microphone in a normal voice, increase the XMTR GAIN control until the S meter starts kicking up scale above its resting value. With no modulation, the S meter will rest up scale on transmit. This indicates that the transmitter AGC is starting to operate and the transmitter has maximum output. Continue talking and reduce the VOX gain until a point is reached where further reduction results in a too frequent relay drop out. Increase the AF GAIN until received signals are of the desired level. This may cause the transceiver to cycle back and forth between transmit and receive. Adjust the ANTIVOX control until the cycling stops. If the push-to-talk switch on the microphone is properly connected as described under Installa-

tion, it may be depressed at any time, thus overriding the VOX system. If VOX operation is not desired, turn the VOX gain control fully counterclockwise.

On SSB, the TR–4C transmits on exactly the same frequency on which it receives. Therefore, be sure that you have the signals tuned in so that the voices sound normal before you answer another station's CQ, or break another QSO. Otherwise, you will not be transmitting exactly on frequency. If a key is used, it must either be closed or unplugged from the KEY jack for SSB and AM operation.

3-9. CW OPERATION.

To operate CW, connect a key to the KEY jack. If an electronic keyer is used, connect it for grid block keying. Leave the key in the open condition. The TR–4C uses shifted carrier CW. With this system, it is possible to transmit approximately on the received station's frequency without being zero beat while receiving. The transmitter BFO is shifted from the received signal frequency by approximately 1 kHz. The VFO dial reads the correct frequency of a received signal when the signal is tuned for zero beat.

To receive CW signals, place the Mode switch in the X-CW position and the SIDEBAND switch in the X position. Tune in a CW signal for an audio pitch of about 1 kHz and adjust the audio gain control knob for a normal listening level.

To transmit, depress the key, and adjust the XMTR GAIN control until it is just below the point at which plate current no longer increases. Do not advance it beyond this point. Advance the SIDETONE control on the rear of the chassis until the sidetone reaches the desired volume. Adjusting the RCVR GAIN knob controls both the received signal and sidetone level.

The TR–4C uses automatic transmit/receive switching. This means that it will automatically transmit when the key is depressed and will remain in the transmit condition during keying. It will return to the receive condition when the key is released for a brief period. If this period is too long, decrease the VOX gain. Manual transmit/receive switching can be accomplished by connecting an external switch to the push-to-talk circuit of the MIC jack.

3-10. AM OPERATION.

For AM operation, the Mode switch should be in the X-AM position and the SIDEBAND switch should be in the X position. If a key is used, it should be left closed or unplugged. Tune in AM signals for most pleasing audio. This will not necessarily coincide with maximum S meter reading. The same procedure should be followed in setting the various gain controls on AM as on SSB, except that the XMTR GAIN control should be adjusted for plate current peaks of 0.2 to 0.25 Amperes when talking into the microphone in a normal voice. Care should be taken to stay within these limits since the transmitter AGC does not operate on AM.

3-11. OPERATION NEAR BAND EDGES.

When operating near the edge of a band, be sure to check the dial calibration as described under tuning procedure. When working SSB be sure to use the sideband that will be inside the band. On AM and CW, the transmitted carrier will be 1 kHz higher or lower than the indicated dial frequency.

3-12. OPERATION WITH A LINEAR AMPLIFIER.

Since the TR–4C Transceiver is conservatively rated at 300 watts PEP input, it is doubtful if it would be worthwhile to use a linear amplifier with a power rating of less than 1000 to 2000 watts PEP input. A triode type grounded grid linear amplifier with a 1000 to 2000 watt PEP rating will present a satisfactory load to the TR–4C.

If the linear amplifier is of the grounded cathode type with high impedance input, it will be necessary to install a resistive pad between the TR–4C and the linear amplifier that will present the proper impedance to the TR–4C. Such a pad must be made of non-inductive resistors and must have adequate power handling capacity. Antenna switching should be accomplished as shown in figure 2-7. Most linear amplifiers have these relays built-in.

To properly operate the TR–4C with a linear amplifier proceed as follows:

a. With the TR–4C connected to the linear amplifier tune the RF TUNE control as described in paragraph 3-7 g.
b. Set the LOAD control to the setting indicated on the chart below, for the band desired, when using a linear amplifier with a 50 ohm input.

BAND	50 Ohm LOAD Setting
3.5 MHz	2
7.0 MHz	3
14.0 MHz	2
21.0 MHz	3
28.5 MHz	2

c. Tune the PLATE control for minimum plate current.
d. Switch the Mode switch to the desired mode of operation.
e. Advance the XMTR GAIN control until the desired amount of input to the linear amplifier is obtained.

Note that when the TR–4C is loaded much below maximum RF output the AGC does not function properly and flat topping in the TR–4C may result. Care should be taken to keep the XMTR GAIN below the point where this occurs. This can be accomplished by making sure that the average peak plate current does not exceed one half of the plate current obtained on tune up.

If your linear amplifier has AGC output, connect it to the TR–4C as shown in figure 2-7. If the TR–4C is properly tuned, this should prevent flat topping on SSB regardless of the XMTR GAIN control setting. However, it will not prevent overdrive on AM since the AGC does not function in this mode.

3-13. NOVICE OPERATION.

If used on the novice bands with crystal control or VFO control, maximum legal input power is 75 Watts which occurs when the Plate Meter reads 0.115 Ampere. To realize the most useful output under these conditions, readjustment of the Bias control on the Power Supply is suggested. Follow the Bias Adjustment procedure in paragraph 3-6, except set bias control on AC–4 for minimum readable plate current. If the transceiver is used on both novice band and by another operator on SSB or AM, the bias must be readjusted to its former value before such operation is attempted.

To load the transmitter for novice operation, preset controls as described in paragraph 3-6. Turn the MODE switch to X–CW and advance XMTR GAIN for a very slight increase in plate current. Tune RF TUNE for a peak in plate current, being careful not to exceed 0.115 Ampere, and quickly tune PLATE control for a dip in plate current. Turn XMTR GAIN control fully clockwise and adjust LOAD control until plate dip occurs at 0.115 Ampere. If plate current dip is higher than this when LOAD control is set to 0, reduce the XMTR GAIN for plate reading of 0.115 Ampere. Turn MODE switch to X–CW and set GAIN control for a plate current of 0.115 Ampere.

NOTES

CHAPTER IV
THEORY OF OPERATION

4-1. GENERAL.

The TR–4C is a 300 Watt HF single sideband transceiver which covers the 80 through 10 meter amateur bands. AM and CW modes are also included. The TR–4C requires either an R. L. Drake AC–4, 120 V AC power supply, or an R. L. Drake DC–4, 12 V DC power supply. The TR–4C features a high-stability linear permeability tuned VFO and two 8 pole crystal lattice filters for sideband selection. Some of the circuits are common to both the transmit and receive functions. Refer to the block diagram figure 4-1 and the schematic diagram figure 5-5 as required to supplement the following discussion.

4-2. RECEIVER CIRCUITRY.

A signal entering the antenna terminal passes through the antenna switching contacts of the relay and is applied to the grid of the RF amplifier V7 through the selectivity of the L/C network formed by T9, T10 and a section of the RF TUNE capacitor C37. After being amplified, it is passed through an additional L/C network consisting of T7, T8 and the remaining section of C37, to the grid of the mixer V3B. At this point it is combined with a signal from the premixer system of the required frequency to yield a 9.0 MHz IF. The premixer system consists of a 4.9-5.5 MHz solid state permeability tuned VFO, a buffer Q2, a switchable overtone crystal oscillator V1A, the premixer pentode V1B and a cathode follower V3A.

The VFO signal output is applied to the grid of the premixer pentode through the buffer Q2 and its associated circuitry. For 80 and 20 meter operation, the VFO signal bypasses the premixer and is connected through the cathode follower to the mixer. On 40, 15 and 10 meters a signal from the crystal oscillator heterodynes with the VFO in the premixer, V1B, to produce the desired injection frequency. On 40 meters, for example, a 21.5 MHz overtone crystal and the appropriate coil L1 are switched into the crystal oscillator circuit. The output from the oscillator is coupled into the premixer pentode where it heterodynes with the 4.9-5.5 MHz VFO to produce an output frequency of 16.0-16.6 MHz. This output is coupled through the 16.0-16.6 MHz bandpass coupler, T3, and to the cathode follower, V3A. On 15 meters, a 35.5 MHz crystal is used with a 30.0-30.6 MHz coupler, T2, and on the three 10 meter ranges, 42.5, 43.0 and 43.6 MHz crystals are used with a 37.0-38.7 MHz coupler, T1.

The 9.0 MHz output of the mixer, V3B, passes through the impedance matching transformer T6 into the upper or lower sideband crystal filter. The setting of the SIDEBAND knob determines which crystal filter is used. From the crystal filter the signal passes through the impedance matching transformer, T13, and is amplified by the 9 MHz receiver IF amplifier system, V11 and V12 and the IF transformers T11 and T12. The output of T12 is applied to the AGC amplifier, V13A, to the product detector, V16, and to the diode detector, V2.

The AGC amplifier V13A is biased beyond cutoff to provide an AGC delay. When sufficient RF voltage from T12 is applied to its grid, plate current flows during part of the cycle. This causes amplified negative voltage to appear across its plate load resistor R63, thus charging C115. This negative control voltage is applied to the grids of V7, V11 and V12. C115 discharges through R63 with a time constant of approximately one second. Rotating the RF Gain control counterclockwise applies increasingly more negative bias to the AGC controlled grids, thus limiting their maximum gain.

The product detector tube, V16, consists of a 9 MHz crystal oscillator formed by the cathode, grid 1 and grid 2. A product detector is formed by the cathode, grid 3, and the plate. The IF signal is applied to grid 3 where it heterodynes with the BFO voltage in the tube. The resulting audio signal is of sufficient amplitude to drive the audio preamplifier transistor, Q5, which drives the audio output tube, V17.

The IF signal from T12 is also applied to V2 which functions as a diode detector and an audio amplifier in the AM receive mode. The output of this stage is also fed to the Mode switch and is connected to V17 through the Audio Gain control when the Mode switch is in the X-AM position. The output of V17 is applied through the audio output transformer to the phone jack, J5, and to pin 12 of the power connector. Also, output from the plate of V17 is applied to the anti vox rectifier, D6, through the ANTIVOX control.

A 100 kHz crystal calibrator, V5, is switched on when the Mode switch is in the CAL position. Its output is coupled to the grid of the RF amplifier V7.

The S meter in the TR–4C operates in a bridge circuit with the plates of a receiver IF amplifier, V11, and the transmitter IF amplifier, V15 in one leg of the bridge and plate of the audio output tube V17 in the other leg. Receiver AGC voltage applied to V11 on receive and transmit causes these tubes to draw less current, thus unbalancing the bridge, which causes the S meter to read up scale. The bridge is balanced on receive by the ZERO control. On transmit, the meter may rest up scale with no modulation.

4-3. TRANSMITTER CIRCUITRY.

Audio input from the microphone is applied to one section of the microphone amplifier V18 where it is amplified and applied to the remaining section of this tube through one section of the XMTR GAIN control. Output from the cathode of the second triode of V18 is applied to the balanced modulator through the Mode switch for SSB operation. Output from the plate is applied to the grid of the AM screen modulator, V14, and to the grid of the first VOX amplifier triode, V19A, through the VOX control. The output from V19A is rectified by the VOX rectifier, D5, and the resulting positive DC voltage is applied to the grid of the relay control triode, V19B, causing it to conduct and to close the transmit/receive relay.

Audio voltage from V17 is rectified by the anti vox rectifier, D6, which supplies negative voltage to the grid of V19B, and preventing it from conducting and closing the relay when the microphone picks up audio from the speaker.

Cut off bias for the relay tube is obtained from a voltage divider. When the microphone push-to-talk switch is activated the cut off bias is grounded, causing V19B to conduct and close the relay.

RF from the 9.0 MHz crystal oscillator portion of the product detector tube V16 is applied to the balanced diode modulator through the carrier balance control. On SSB the audio from V18 is also applied to the balanced modulator and the result is a double sideband suppressed carrier signal which is applied to the transmitter IF amplifier. The amplified output is coupled through T13 to the upper or lower crystal filter where the undesired sideband is filtered out. The resulting SSB signal is coupled through T6 to the transmitter mixer, V4, where it is combined with a premixer signal of the proper frequency to give output on the desired amateur band.

Output from V4 passes through the L/C circuit, T7, T8 and C37, and is applied to the grid of the driver tube, V6. Here it is amplified and applied to the grids of V8, V9, and V10 through the L/C network, T9, T10 and the other half of C37.

Three parellel power amplifier tubes boost the signal to a power level suitable for transmission. The output impedance of the power amplifier tubes is matched to a 52 ohm load by means of the pi network circuit composed of L8, L9, C94 and C95.

At the first trace of flat topping in the final amplifier tubes, a small amount of grid current will be drawn. This produces a voltage drop across R47. The small negative going voltage thus obtained is applied through R46 to the cathode of V13B where it is amplified. The amplified negative voltage is applied to the grid of V15, thus reducing the level of the driving signal.

When the Mode switch is placed in the X-CW position, V2 becomes an audio phase shift oscillator which is grid-block keyed along with the transmitter mixer, V4, and the driver, V6. The audio output from V2 is applied to the grid of the

product detector tube V16, through the SIDETONE control, to provide audio output from the speaker for CW monitoring. Audio output from V2 is also applied to the grid of the VOX amplifier tube, V19A, which causes relays K1 and K2 to close. The relays turn on the transmitter, cause the 9.0 MHz oscillator to be shifted to 9.001 MHz and apply a variable source of DC, controlled by half of the XMTR GAIN control, to the balanced modulator. The DC voltage which unbalances the modulator increases the carrier to a suitable level. The resulting 9.001 MHz signal from the balanced modulator is amplified by V15 and coupled into the crystal filter. The SIDEBAND control must be in the "X" position to allow the signal to pass. A screen resistor is switched into the final amplifier screen circuit to prevent excessive screen current in the X-CW position of the Mode switch.

When the Mode switch is placed in the X-AM position the AM screen modulator V14 is inserted in series with the final amplifier screen supply and a constant voltage is applied to the balanced modulator. Relay K2 shifts the 9 MHz oscillator to 9.001 on transmit just as it does on X-CW. Vox and PTT functions are the same on AM as on SSB.

When relay K1 is closed, either by the VOX circuit or the push-to-talk switch, the cathode of V3B, V7, V11 and V12 are isolated from ground which disables the receiver. The cathodes of V4, V6, V8, V9, V10 and V15 are connected to ground which actuates the transmitter. Also, the antenna is switched from the receiver input to the final amplifier tank circuit. If the TCVR/RCVR switch is in the RCVR position, the RCVR MUTE jack is grounded through RFC 11 and RFC 7 and the antenna is connected to the RCVR ANT jack instead of T9 in the receive condition of the relays.

Pushing in the LOAD control disconnects the plate current meter from the final amplifier cathode circuit and connects it to the diode D9 and its associated circuitry. This network samples the RF output voltage at the antenna connection, rectifies it, and applies it across the meter.

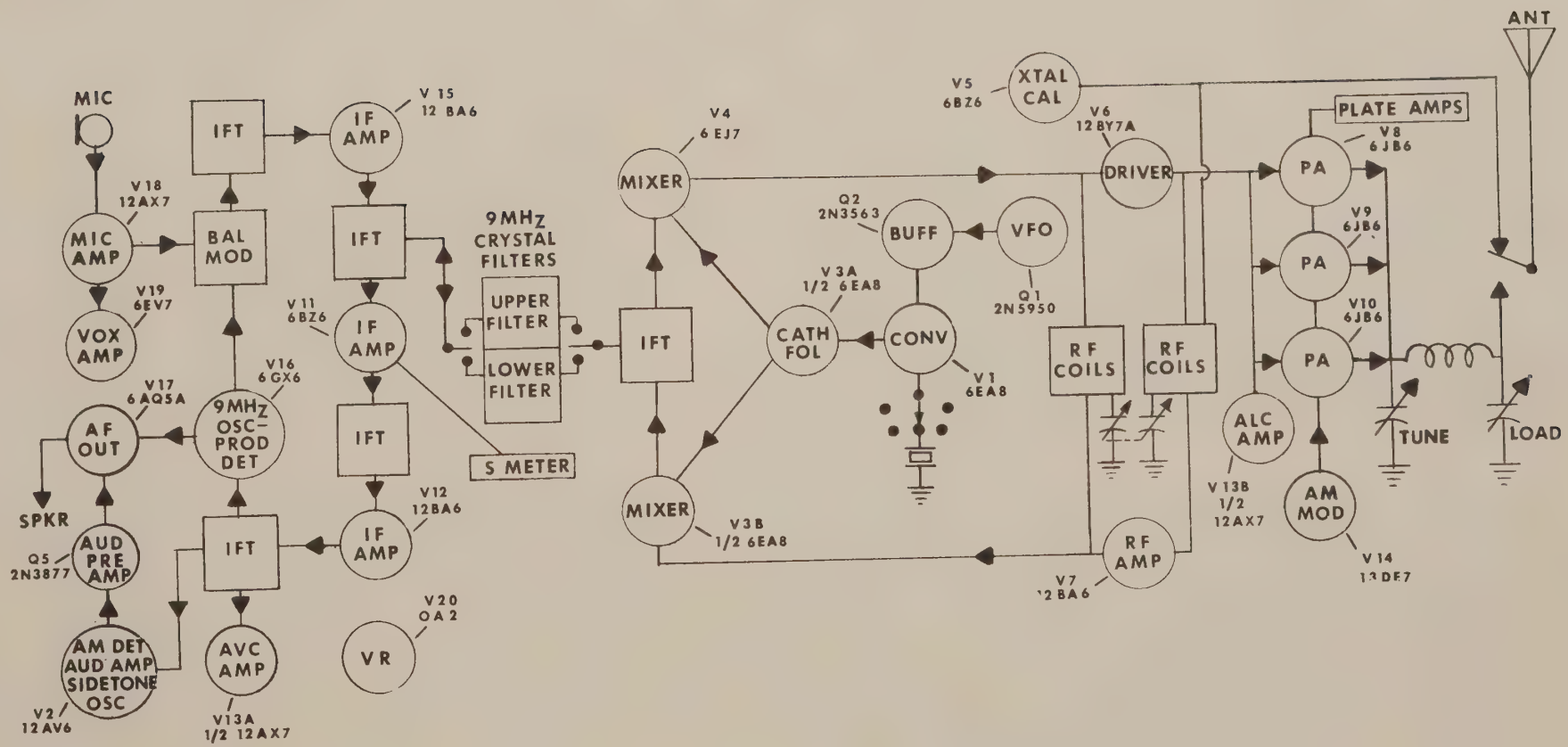


Figure 4—1. Block Diagram

CHAPTER V
MAINTENANCE

5-1. SERVICE DATA.

We will check and align your transceiver at the factory for a nominal fee if it has not been tampered with. Transportation charges are extra. Any necessary repairs will be made on a time and material basis. Please write or call the factory for authorization before returning your unit for alignment or service. Address your request for authorization to:

R. L. Drake Company
540 Richard Street
Miamisburg, Ohio 45342
ATTN: Customer Service Department

Telephone: (Area Code 513) 866-3211
(Code-A-Phone Service after
1630 Hours E.S.T.)

WARNING

Extreme caution should be exercised when the top and bottom covers are removed. High voltage which is present at several points can cause a lethal electrical shock. Repairs and adjustments should be made only by a qualified electronics technician. Disconnect the Power Supply from the TR–4C before removing covers.

5-2. TOP COVER REMOVAL.

Remove the three top screws on each side of the TR–4C and remove the cover by first pulling up on the rear and then the front of the cabinet.

5-3. BOTTOM COVER REMOVAL.

Remove the three bottom screws on each side of the TR–4C and lift the chassis out of the bottom cover.

5-4. TUBE REPLACEMENT.

In general, most trouble in electronic equipment of good design is due to tube failure. The best method of finding defective tubes is by direct substitution. It is best not to rely too heavily on tube checkers. The TR–4C has been designed so that, with the exception of V8, V9 and V10, tubes can be replaced without need for realignment. These tubes are to be replaced with a matched set of the same brand as originally supplied. If a different brand is used, alignment of T7, T8, T9 and final amplifier neutralization is recommended. Matched sets of Sylvania 6JB6's are available directly from the factory. To replace the 6JB6 tubes, it is necessary to remove only the top of the final amplifier cage. To do this, remove the sheet metal screws holding the PA cover to the cage. A disc-handle is provided on the cover to facilitate removal. To replace the PA cover, simply reverse the process. Be sure the parasitic suppressors do not short to the cage.

5-5. TROUBLE SHOOTING.

Careful consideration has been given in the design of the TR–4C to keep maintenance problems to a minimum. However, it is quite possible that some problem will arise which cannot be cured by tube substitution. If this occurs, it is suggested that the TR–4C be returned to the dealer or you may write to the Customer Service Department at the address given in paragraph 5-1. Be sure to describe the problem in detail. Include full information concerning external connections, control settings, tubes substituted, serial number, etc. Always include the serial number when requesting service information. Before returning equipment to the factory, it is necessary to get prior authorization. In case of malfunction, first check the power supply fuse, the filament fuse in the TR–4C and the number 12 fuse lamp near the relay assembly for continuity. The voltage and resistance charts in this chapter should be valuable in isolating minor problems.

However, no attempt should be made to service the TR–4C unless you are thoroughly familiar with electronic circuitry and servicing technique. Care should be taken not to disturb the lead dress in the TR–4C since several circuits are quite critical in this regard.

5-6. TEST EQUIPMENT.

Alignment of TR–4C will require the following equipment:

a. A general coverage receiver capable of receiving WWV.
b. An 11 Megohm VTVM.
c. An alignment load consisting of a 1000 Ohm non-inductive resistor in series with a .005 uF disc ceramic capacitor.
d. A 52 Ohm dummy load.

WARNING

Before receiver alignment is attempted, the plate and screen power leads of the amplifier tubes should be disconnected where they pass through the partition under the chassis. Be sure the power is disconnected before this is attempted, or serious electrical shock may result.

5-7. ALIGNMENT PROCEDURES.

5-8. CRYSTAL CALIBRATOR. To align the crystal calibrator perform the following steps:

a. Let the TR–4C warm up for 30 minutes.
b. Preset the XMTR GAIN control fully counter-clockwise.
c. Set the Mode switch to CAL.
d. Tune in WWV on the general coverage receiver with the BFO off.
e. Connect a wire from the receiver antenna terminal to V5 of the TR–4C. Wrap the wire around the tube a turn or two.
f. Adjust C45, located on top of the TR–4C chassis, until the calibrator signal is zero beat with the unmodulated WWV carrier.

5-9. 9.0 MHz OSCILLATOR.

a. Let the TR–4C warm up for 30 minutes.
b. Set the Mode switch in the SSB position.
c. Turn up the Audio Gain control until noise is audible in the speaker.
d. While switching the SIDEBAND knob back and forth, adjust C130, located on top of the chassis near the rear edge, until the pitch of the noise is the same on both positions.

5-10. INJECTION CRYSTAL OSCILLATOR.

a. Set the VTVM to its lowest DC negative volt scale and set the pointer to about center scale with VTVM zero adjust control.
b. Connect the common lead of the VTVM to the TR–4C chassis and the DC lead to the test point which is connected to pin 9 of V1.
c. Set BAND switch to 7.0 MHz and adjust L1 for maximum negative DC voltage.
d. Switch to 21.0 MHz and adjust L5 for maximum as in Step c.
e. Switch to 29.1 MHz and adjust L2 for maximum as in Step c.
f. The 28.0, the 28.5 and the 29.1 MHz positions should have about the same negative voltage.

5-11. VFO ADJUSTMENT.

The permeability tuned VFO was carefully adjusted at the factory and should require no further alignment. If it does not appear to track from one end of its range to the other, it should be returned to the factory for realignment. Maximum calibration error is 1 kHz when calibrated to the nearest 100 kHz point.

5-12. INJECTION COUPLER.

a. Tune in a crystal calibrator signal at 7.3 MHz.
b. Connect the alignment load between pin 6 of V1B and ground and adjust T3 (top) for maximum S meter reading.
c. Connect the load from pin 9 of V3A and ground and adjust T3 (bottom) for maximum S meter reading.
d. Tune in a crystal calibrator signal at 21.300 MHz and repeat the procedure for T2.
e. Tune in a crystal calibrator signal at 29.000 MHz and repeat the above procedure for T1. *Note:* On T1, adjust the bottom slug when the load is on pin 6 of V1B and the top slug when the load is on pin 9 on V3A.

Table 5–1. Resistance Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	9.5 K	2.5 Meg	20 K	0	Fil	9.6 K	220	220	150 K
V2	12AV6	3.3 Meg	Inf.	Fil	0	150 K	150 K	350 K	—	—
V3	6EA8	8.0 K	150 K	250 K	Fil	0	11 K	2.2 K	1 K	34 K
V4	6EJ7	25 K	660 K	23 K	Fil	0	0	11 K	9.5 K	0
V5	6BZ6	1 Meg	1 K	Fil	0	350 K	125 K	1 K	—	—
V6	12BY7A	25 K	67 K	0	0	0	Fil	8.5 K	25 K	0
V7	12BA6	2.8 Meg	0	Fil	0	11 K	10K	100	—	—
V8	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V9	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V10	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V11	6BZ6	2.5 Meg	150	0	Fil	10 K	13 K	0	—	—
V12	12BA6	2.5 Meg	0	Fil	0	10 K	13 K	68	—	—
V13	12AX7	1 Meg	22 K	45 K	0	0	2.2 Meg	55 K	48 K	Fil
V14	13DE7	8 K	2.5 Meg	2.5 Meg	Fil	0	2.2 Meg	22 Meg	0	Inf.
V15	12BA6	2 Meg	0	0	Fil	10 K	13 K	25 K	—	—
V16	6GX6	2.2 Meg	1 K	0	Fil	250 K	9.2 K	22 K	—	—
V17	6AQ5	500 K	270	0	Fil	8.7 K	8 K	500 K	—	—
V18	12AX7	350 K	6.8 Meg	0	0	Fil	350 K	500 K	3.3 K	N. C.
V19	6EV7	13 K	4.5 Meg	0	Fil	0	110 K	450 K	820	1.5 Meg
V20	OA2	7.8 K	0	Inf.	0	7.8 K	Inf.	0	—	—

REF DES	Transistor Type	MEASURED AT:		
		Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	5.6 K	43 K
Q4	2N3394	0	750	1.1 K
Q5	2N3877	1 K	56 K	6.8 K

NOTE:
All measurements were made with respect to ground with the power supply disconnected from the TR–4C. The BAND switch was on 7.0 MHz, the Mode switch was on CAL and the RCVR GAIN and XMTR GAIN controls were fully clockwise. The VOX, ANTI VOX and SIDETONE controls were fully clockwise and the ZERO control was set at the balance point. The accessory 34–PNB jumper plug was in the noise blanker jack.

Table 5–2. Voltage Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	122	–2	125	0	6.3*	250 245	2.6	2.6	–1.3
V2	12AV6	0 –1.6	13.0 0	12.6*	0	0 0.9	0 0.9	255 122	—	—
V3	6EA8	155 150	0	98 150	6.3*	0	260 250	3.5 150	17 15.5	17 15.2
V4	6EJ7	155 2.8	0	NC	6.3*	0	0	270 230	175 145	—
V5	6BZ6	–42 0	0.9 23	12.6*	6.3*	70 140	58 144	0.9 23	—	—
V6	12BY7A	155 3.3	0	NC	0	0	6.3*	265 240	262 165	0
V7	12BA6	–.14	0	12.6*	0	235 230	98 110	1.25 150	—	—
V8	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V9	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V10	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V11	6BZ6	–.16	1.6 150	0	6.3*	235	125 150	0	—	—
V12	12BA6	–.16	0	12.6*	0	240	105 150	1.1 150	—	—
V13	12AX7	–.1 0	–61 –61	–59 –59	0	0	–.16	–61 –61	–59 –58	6.3*
V14	13DE7	260 250	11.4 11.2	11.4 11.2	12.6*	0	11.4 11.2	–1.0 –1.0	0	64 53
V15	12BA6	0	0	0	12.6*	248 140	155 144	155 1.3	—	—
V16	6GX6	–6.0 –5.6	4.0	0	6.3*	140 140	140	0	—	—
V17	6AQ5	0	7.2 6.8	0	6.3*	240 230	155 150	NC	—	—
V18	12AX7	88 87	–.75	0	0	12.6*	130 125	0	1.23 1.1	NC
V19	6EV7	260 180	–6 –.36	0	6.3*	0	103 110	0	1.25 1.20	TP
V20	OA2	146	NC	NC	NC	NC	NC	0	—	—

Table 5–2. Voltage Chart (continued)

REF DES	Transistor Type	MEASURED AT:		
		Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	0	61
Q4	2N3394	0	11.2	0
Q5	2N3877	2.3	2.8	48

NOTE:
All measurements were made with an 11 Megohm VTVM and were taken from ground. RF TUNE, PLATE and LOAD controls were set as described in paragraph 3-7. BAND switch was on 7.0 MHz, VFO dial was at 7.250 MHz and SIDEBAND was on X. Receive measurements were made with the Mode switch in the CAL position and the transmit measurements were made with the Mode switch in the X-CW position, with the following exception:

On V14, both receive and transmit measurements were made with the Mode switch in the X-AM position and with PTT line grounded.

The AC–4 Power Supply was used. Where two voltages are shown, the top is for receive and the bottom is for transmit. An "*" indicates AC voltage. The accessory 34–PNB jumper plug was in the noise blanker jack.

5-13. RECEIVER IF.

a. Peak the RF TUNE control on noise at 3.8 MHz.
b. Adjust T11 top and bottom and T12 top and bottom for maximum noise from the speaker.

5-14. BALANCED MODULATOR AND CARRIER BALANCE.

a. Disconnect the power supply and reconnect the screen and plate supply leads to the final amplifier tubes.
b. Reconnect power supply.
c. Connect dummy load to the antenna jack.
d. Peak the RF TUNE control for maximum receiver gain.
e. Adjust bias per paragraph 3-6. With XMIT GAIN fully counterclockwise, place the Mode switch in X–CW position and SIDEBAND switch in X position.
f. If the plate current exceeds 0.15 Ampere, adjust the RF TUNE for 0.15 Ampere maximum.
g. If plate current is less than 0.15 Amperes, adjust Carrier Balance pot until plate current reaches 0.15 Amperes.
h. Peak T14 for maximum plate current. Detune the RF TUNE control to prevent plate current from exceeding 0.15 Amperes.
i. Alternately adjust the Carrier Balance control and C127 for minimum plate current. There should be no difference in plate current between the two positions of the SIDEBAND switch.

5-15. FILTER MATCHING TRANSFORMER.

a. Adjust the S meter ZERO pot for zero S meter deflection (S-1).
b. With the SIDEBAND switch in USB, tune in the calibrator signal at 3.8 MHz for maximum S meter reading.
c. Adjust the RF TUNE control until the S meter reads S-9.
d. Turn the VFO control clockwise to increase the audio frequency until the S meter drops to S-5.
e. Adjust T6 and T13 for maximum S meter reading.
f. Repeat Steps b. through e.
g. Center the 9.0 MHz oscillator as described in paragraph 5-9.

5-16. MIXER AND RF ALIGNMENT.

a. Tune up the TR–4C at 3.8 MHz for maximum power output into a dummy load. Set the RF TUNE control on 5. Adjust the XMTR GAIN control for 0.2 Amperes plate current as indicated by the plate meter. Adjust T7 bottom and T9 bottom for maximum plate current.
b. Tune up the TR–4C at 7.3 MHz and repeat a. above, with the RF TUNE control on 6, by adjusting T8 top and T10 top.
c. Set RF TUNE control on 5. Tune up the TR–4C at 14.3 MHz and repeat a. above by adjusting T7 top and T9 top.
d. Tune up the TR–4C at 29.7 MHz (crystal not supplied). With the RF TUNE control at 9¾ repeat a. above by adjusting T8 bottom and T10 bottom.
e. Set RF TUNE control on 5. Tune up the TR–4C at 21.3 MHz and repeat a. above by adjusting L6 and L7.

5-17. PA NEUTRALIZATION.

a. Attach an RF output indicator between the TR–4C and the dummy load. If no external output indicator is available, the TR–4C's own RF output indicator may be used.
b. Tune up the TR–4C on 29.0 MHz for maximum power output into a dummy load.
c. Reduce plate current to 0.2 Amperes with the XMTR GAIN control.
d. While tuning the PLATE control back and forth through resonance, adjust C76, using an insulated screwdriver, until the plate current dip and maximum RF output occur simultaneously. An insulated screwdriver is required because the rotor of C76 is connected to + 250 Volts DC.

5-18. TRANSMITTER IF NEUTRALIZATION.

a. With microphone plugged into TR–4C, turn the VOX gain fully counterclockwise and turn XMTR GAIN fully clockwise. Place the Mode switch in the SSB position.
b. While talking into the microphone, increase the RCVR GAIN control setting until speech can be heard from the speaker.
c. Adjust C168 for minimum output from speaker.
d. If over one turn of adjustment is required, it will be necessary to realign T14, C127 and the Carrier Balance control.

5-19. S METER ADJUSTMENT.

With the RF GAIN control fully counterclockwise adjust R187 for an S meter reading of 60 dB over S-9.

Table 5–3. Tube and Semiconductor Complement

REF DES	Component Type	FUNCTION	
		Transmitter	Receiver
V1	6EA8	Pre-Mixer/Xtal Oscillator	Pre-Mixer/Xtal Oscillator
V2	12AV6	Sidetone Oscillator	Diode Det/1st AF Amplifier
V3	6EA8	Cathode Fol.	Mixer/Cathode Fol.
V4	6EJ7	Mixer	—
V5	6BZ6	—	Crystal Calibrator
V6	12BY7	Driver	—
V7	12BA6	—	RF Amplifier

Table 5–3. (Continued)

REF DES	Component Type	FUNCTION	
		Transmitter	Receiver
V8, V9, V10	(3) 6JB6 Matched	Power Amps.	—
V11	6BZ6	—	IF Amplifier
V12	12BA6	—	IF Amplifier
V13	12AX7	AGC	AGC
V14	13DE7	AM Screen Modulator	—
V15	12BA6	IF Amplifier	—
V16	6GX6	9 MHz Xtal Oscillator	BFO/Product Detector
V17	6AQ5A	Anti Vox	Audio Output
V18	12AX7	Mike Amplifier	—
V19	~~6EV7~~ 6FQ7	VoxAmp/Relay	—
V20	OA2	Voltage Regulator	Voltage Regulator
Q1	2N5950	VFO	VFO
Q2	2N3563	VFO Buffer	VFO Buffer
Q3	AT5059	Neon Driver	Neon Driver
Q4	2N3394	VFO Shut Off	VFO Shut Off
Q5	2N3877	—	Audio Pre-Amp
D1	1N541	Balanced Modulator	—
D2	1N541	Balanced Modulator	—
D3	1N541	Balanced Modulator	—
D4	1N541	Balanced Modulator	—
D5	1N4148	Vox Detector	—
D6	1N4148	Anti Vox Detector	—
D7	1N4148	Vox Relay Speed Up	—
D8	1N714	Voltage Regulator	Voltage Regulator
D9	1N4148	Output Power Detector	—
D10	1N4148	Anti Vox Detector	—
D11	1N4148	Output Power Detector	—
D12	1N4148	Meter Control	—
D13	1N4148	Transient Suppressor	Transient Suppressor
D14	1N4148	AGC Isolation	—

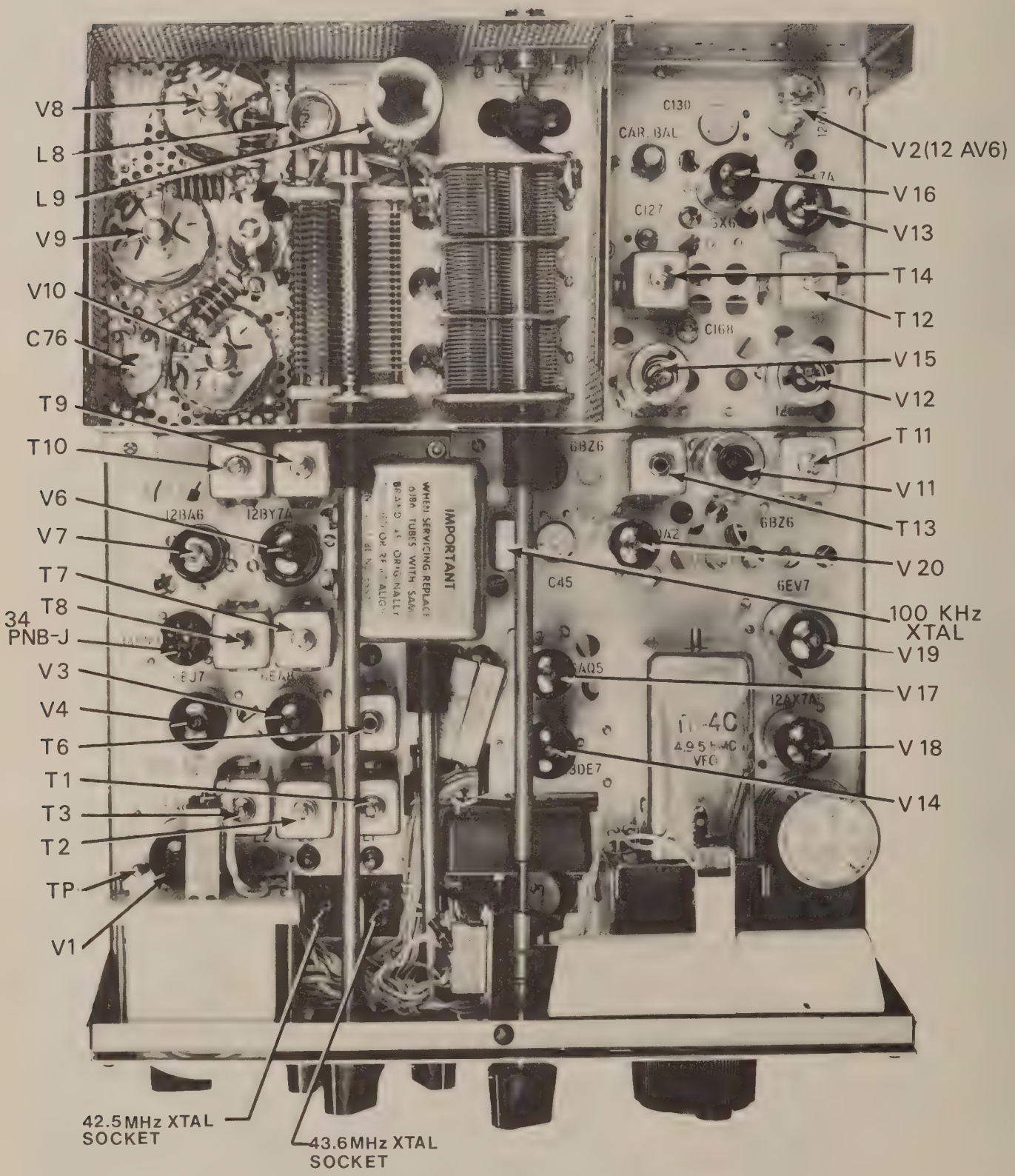


Figure 5–1. Alignment Locations, Top View

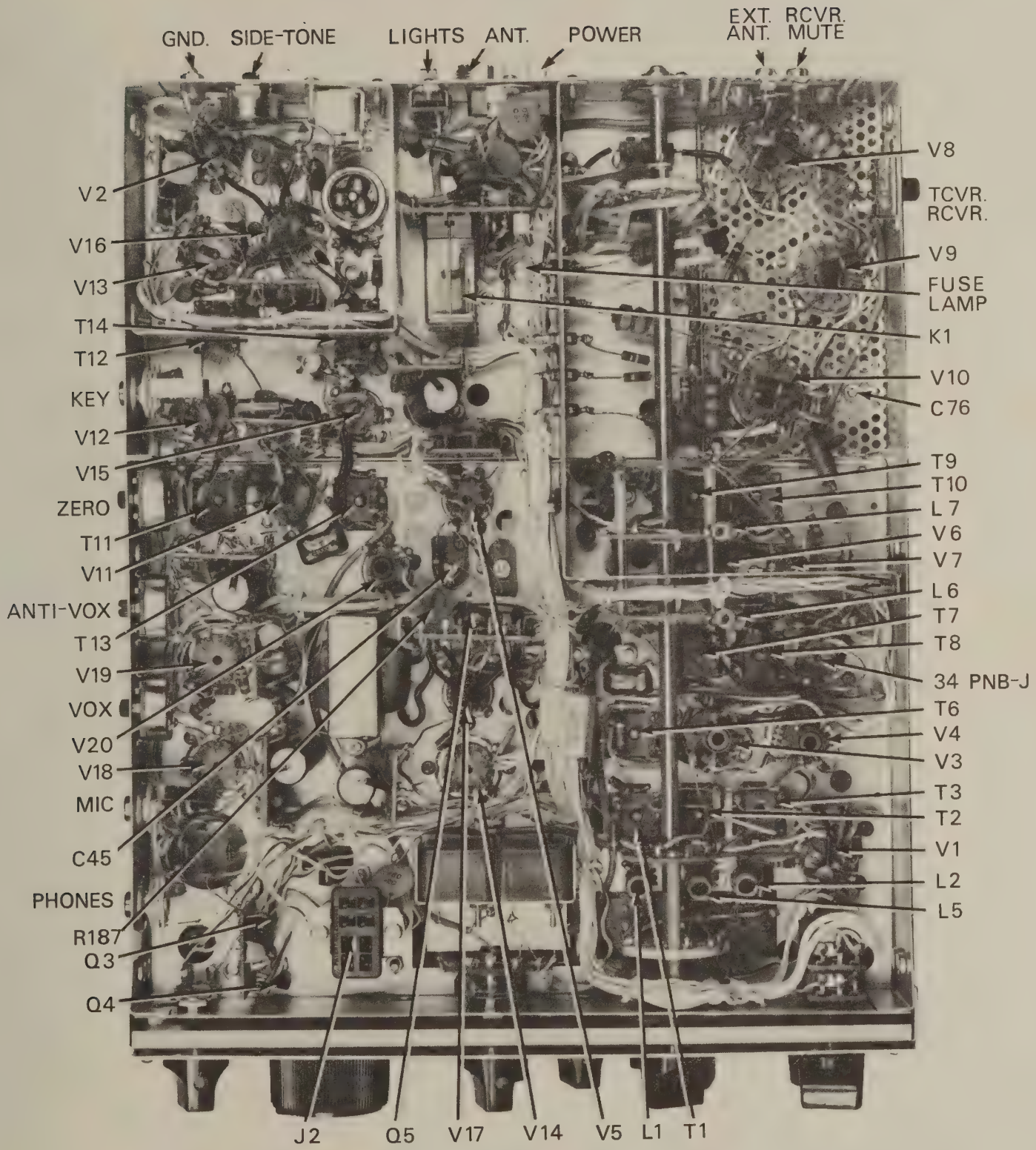


Figure 5–2. Alignment Locations, Bottom View

NOTES

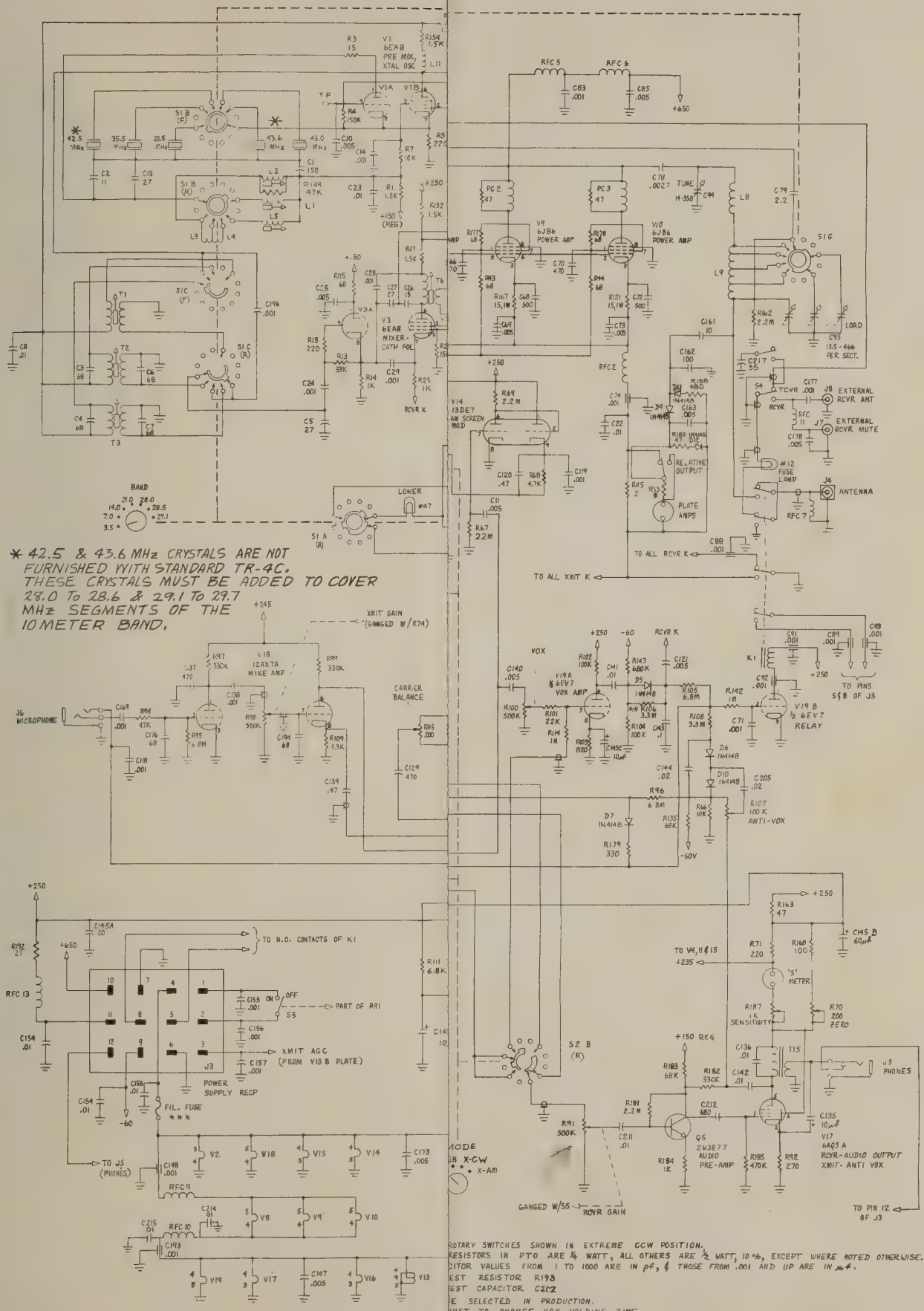


Figure 5–5. TR–4C Schematic

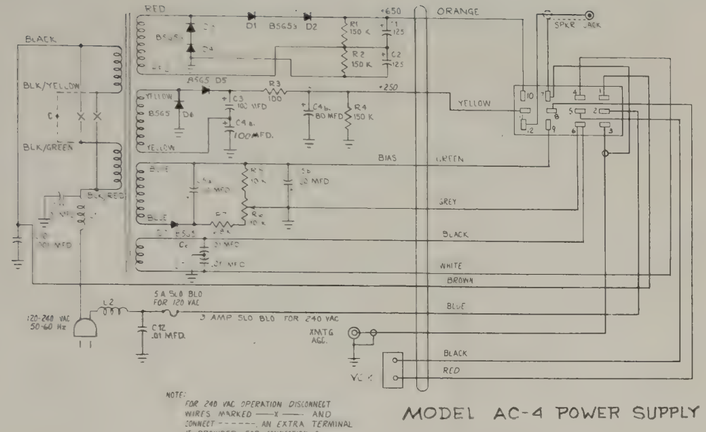


Figure 5–3. AC–4 Power Supply Schematic

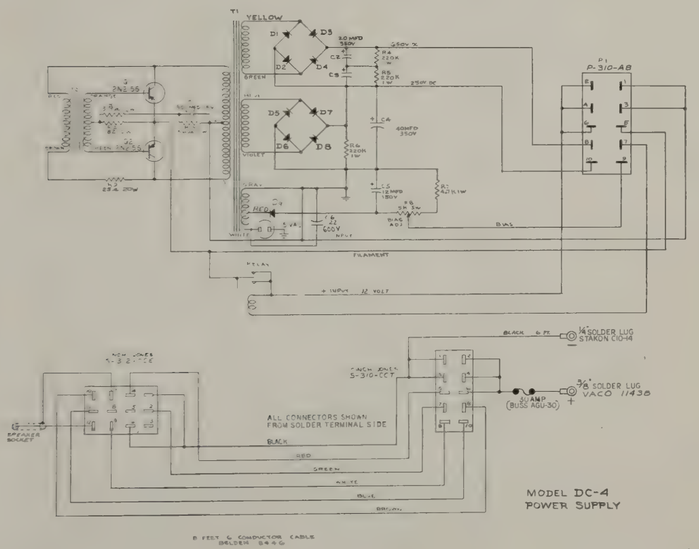


Figure 5–4. DC–4 Power Supply Schematic

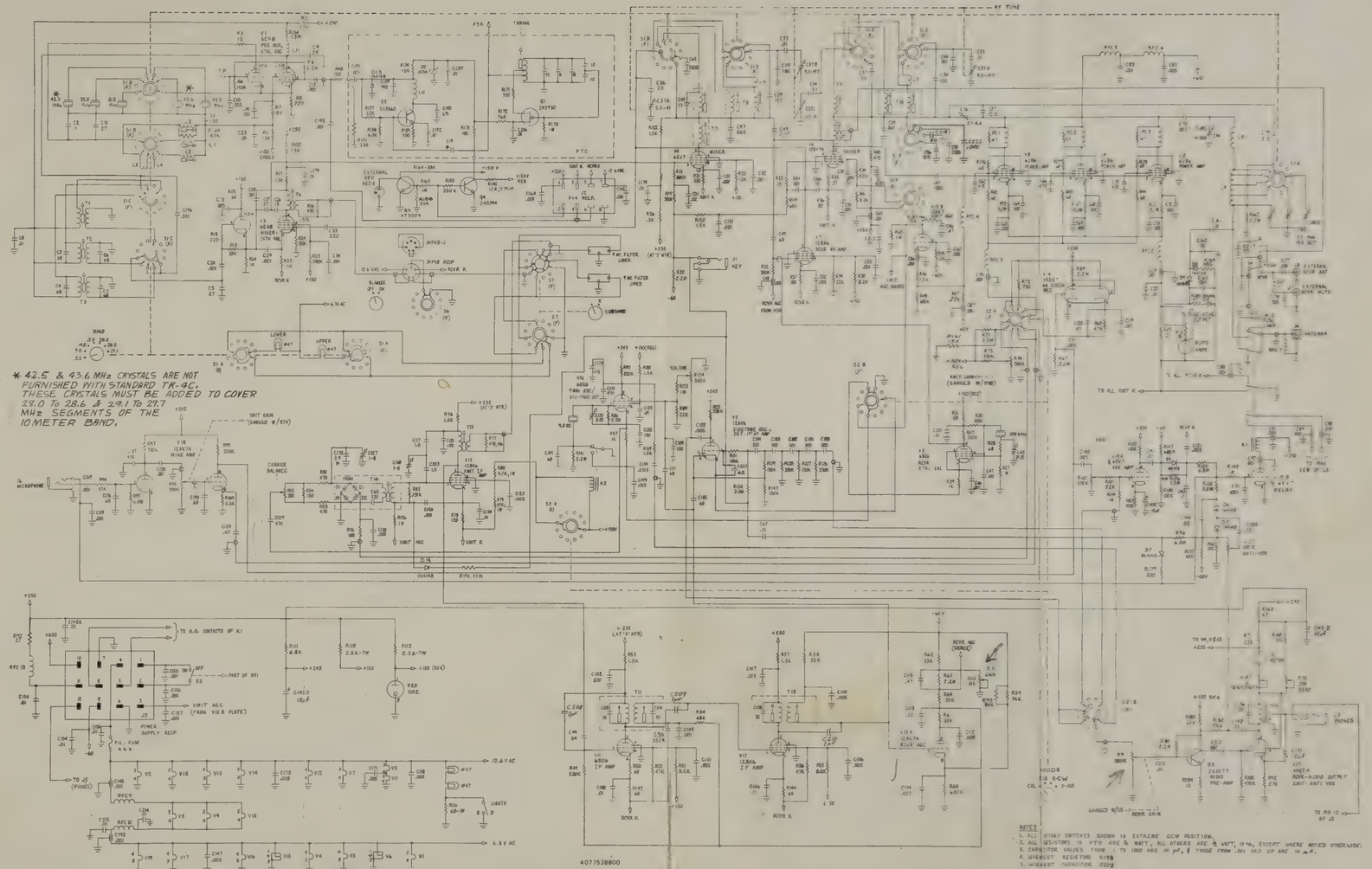


Figure 5–5. TR–4C Schematic

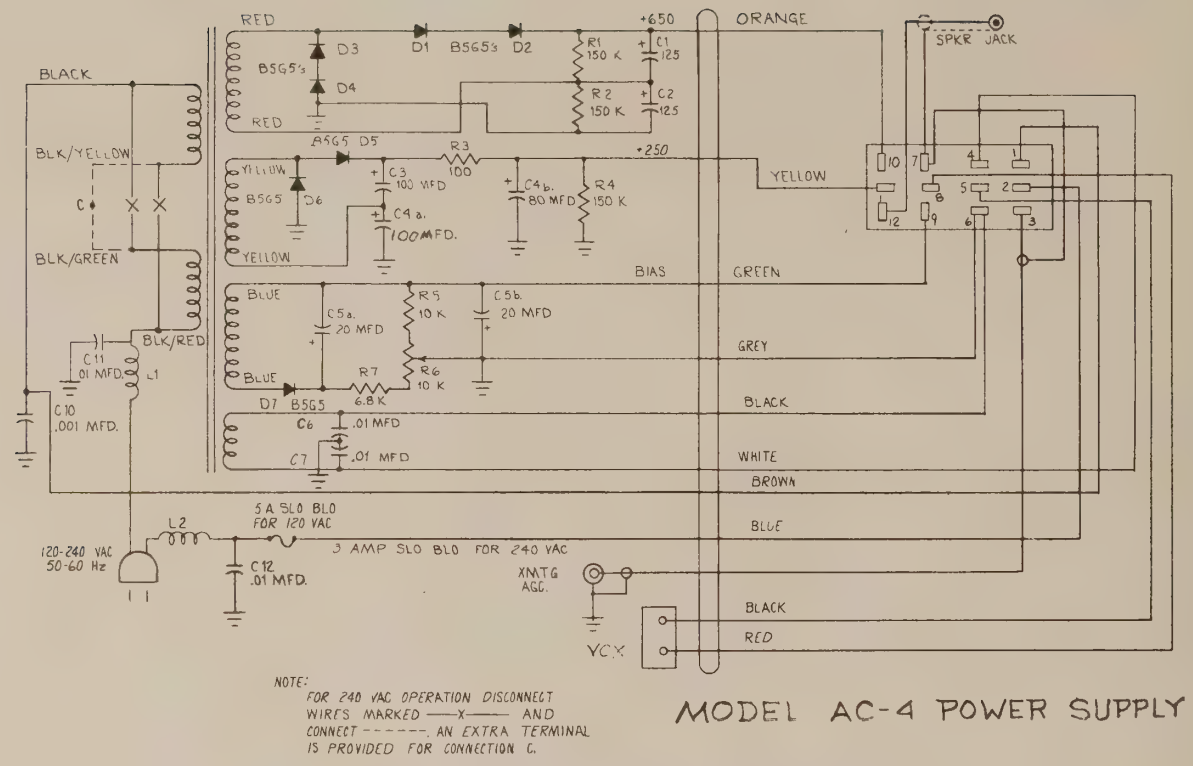


Figure 5–3. AC–4 Power Supply Schematic

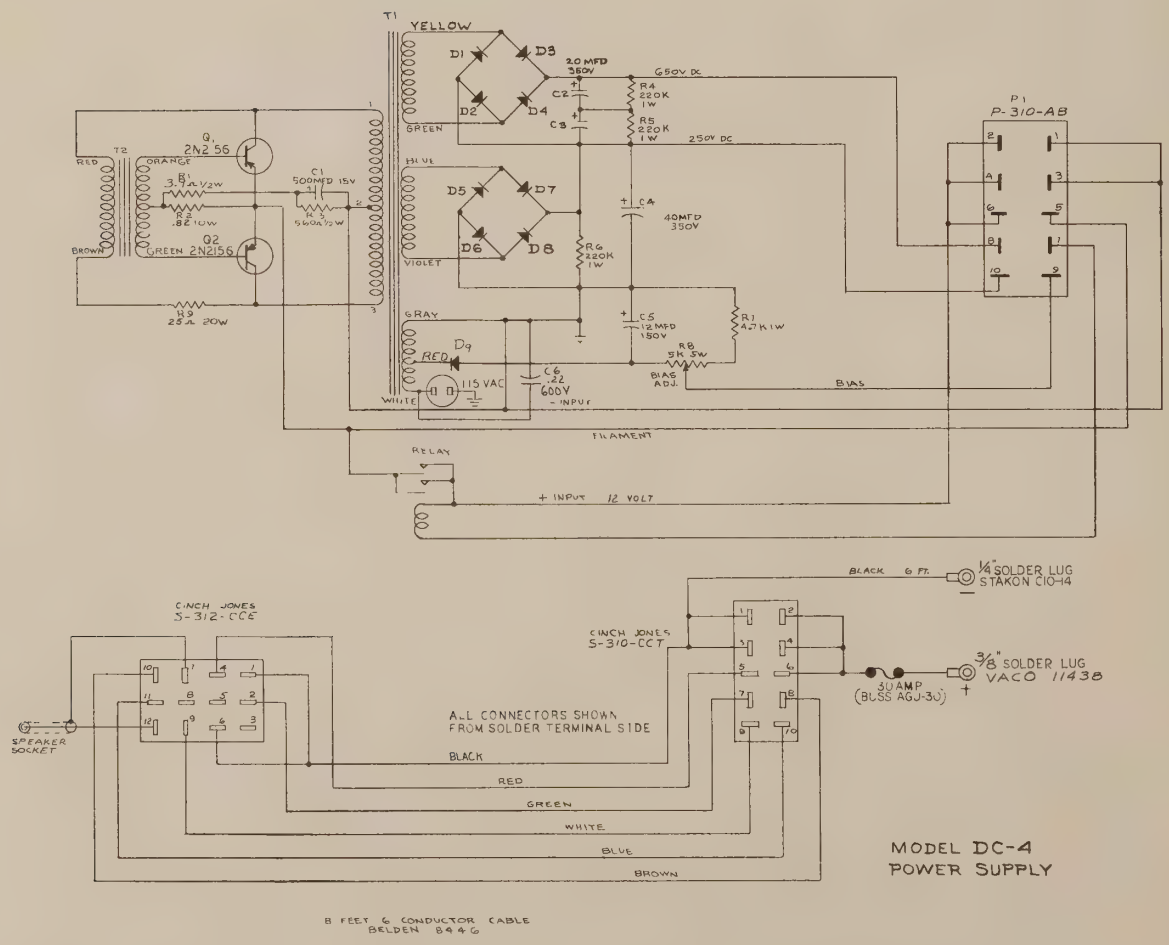


Figure 5–4. DC–4 Power Supply Schematic

Re: TR-4C Transmit problem

[Follow Ups] [Post Followup] [Drake Message Board] [FAQ]

Posted by Michael on August 03, 2002 at 13:37:50:

In Reply to: TR-4C Transmit problem posted by Jay N1FDX on May 22, 2002 at 14:15:24:

: Radio appears to stay in transmit mode with the T/R relay in transmit position. No RF output and final are glowing red hot. If I remove the T/R relay radio appears to recieve.
: Any Ideas.

You did not state what mode the TR4C was in so I'm going to assume it is CW. If so then ensure you have a key or phone plug inserted in the CW jack on the back of the TR4C. If this is not the case then pull V19, the VOX amp/relay control tube and power the TR4C on. If this cures the problem then replace V19. If it does not then replace V2 12AV6 (Side tone, DET and 1st AF AMP). Pulling this tube will disable the audio output in receive since it's the receiver's Detector. If the side tone is constantly on even with a phone plug in the CW jack and the key is not depressed, then the side tone is tuning the VOX amp on and the output of the VOX amp is keying the relay tube V19 which is keying the transmitter. Also try adjusting the VOX amp and Delay controls on the right side of the TR4C. I have found that noise will cause the TR4C to go into transmit if the VOX amp and Delay controls are not set properly. I assume the finals do not glow Red Hot for at least a few minutes after power up.

Michael
DA1TNJ/WB8TNJ

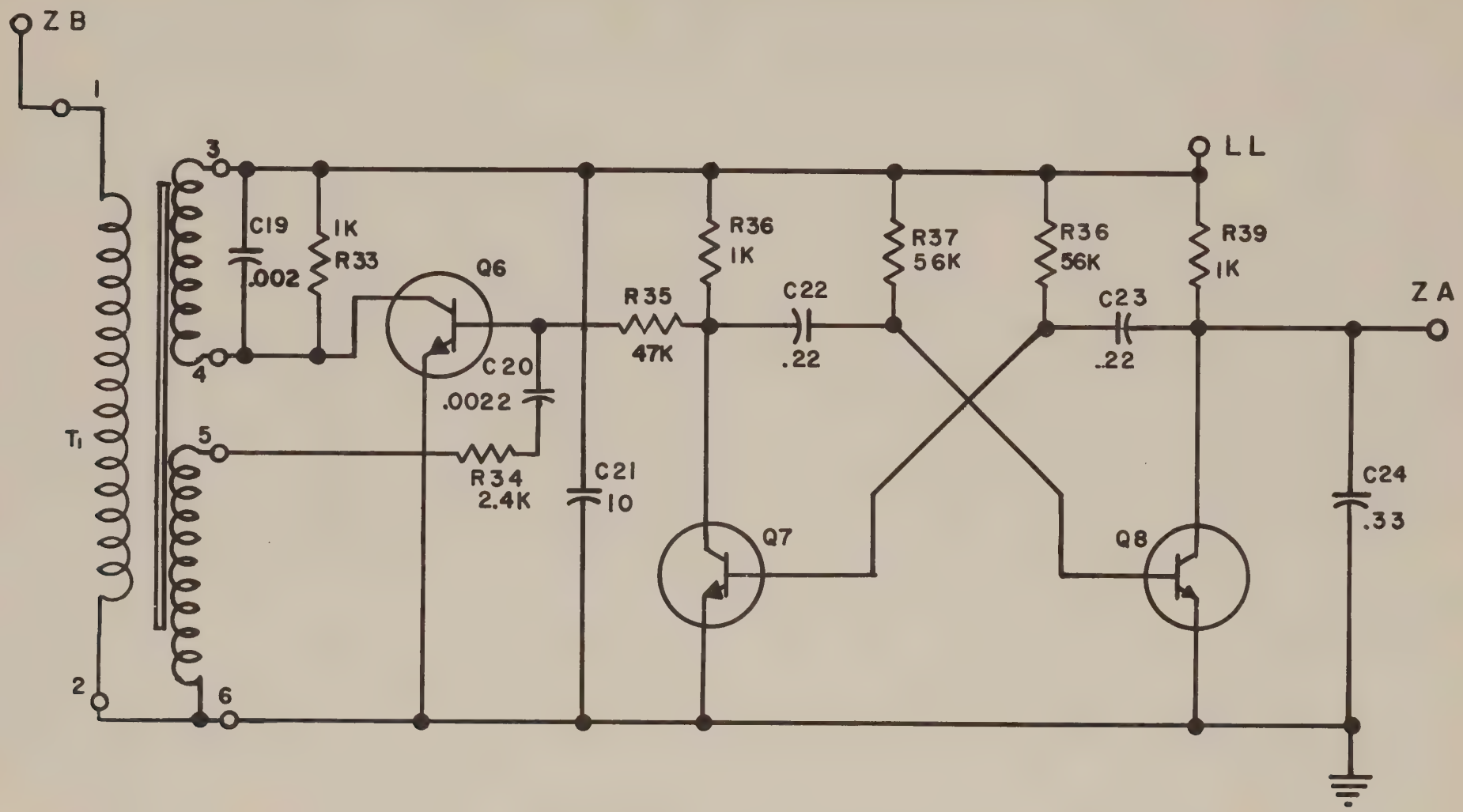
Follow Ups:

Post a Followup

Name:
E-Mail:

Subject: Re: TR-4C Transmit problem

Comments:



312A CHOPPER DRIVE

FIGURE 17

Drake Home Page Drake Technical Tips Menu

AC4 / AC3 POWER SUPPLY TROUBLE SHOOTING

By: Mark Gilger, WB0IQK

In the following procedures you will be close to dangerous high voltages. Be careful.

- The first of the procedures has you verify the voltages at the connector. The second req to remove the bottom cover for further testing. The second parts is only required if indicate results of the first.

- The AC4/AC3 can be divided up into AC and DC sections as pictured below.

- The supply also has 4 separate sections that supply different voltages.

- The High Voltage (HV) section supplies approximately +650 volts used by the tube final amplifier section.

- The Low Voltage (LV) supplies approximately +250 volts to most other sections of the radio.

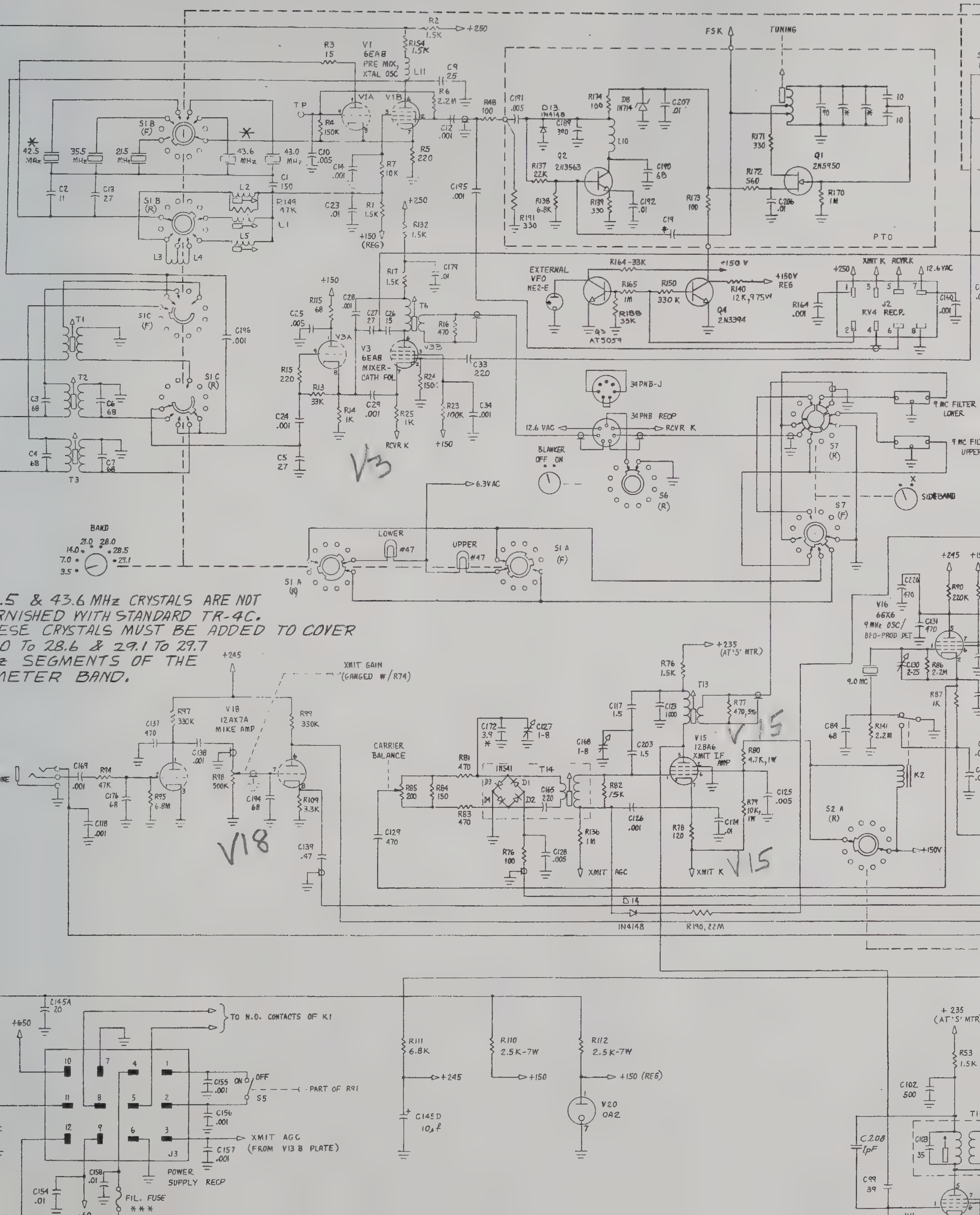
- The Bias supply, supplies the needed negative (-) bias voltage to the amplifier sections.

- Last is the filament supply. This supplies the needed AC voltage to all of the tubes in the radio.

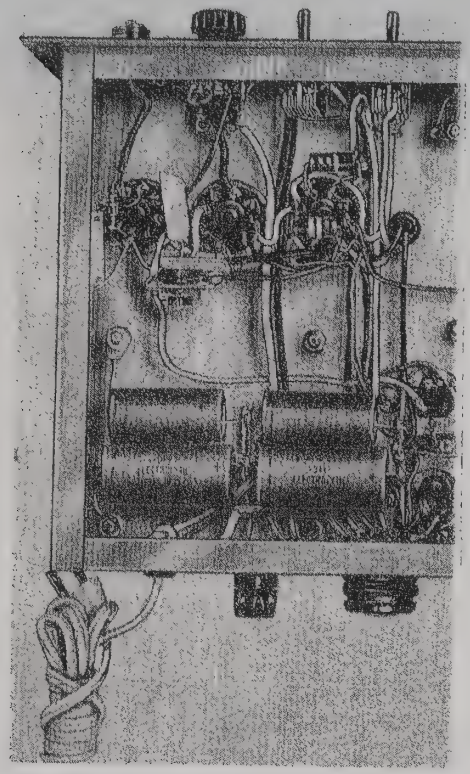
- The supply also routes the transmitter ALC and amplifier relay keying voltage to plugs on the rear of the AC4/AC3 for use by a remote amplifiers.

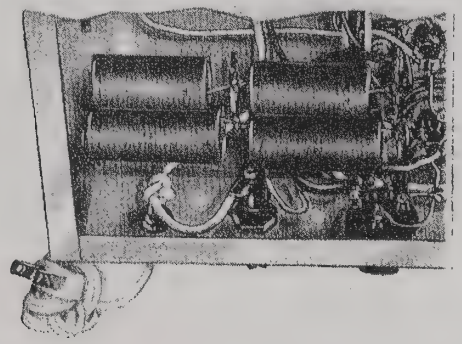
- Unplug the supply from the outlet.

- In order to get the AC4/AC3 powered up, we need to simulate the power on/off switch inside of the radio. This requires us to short pins #1 & 2 together with a jumper. Use the figure below to following the circuit. Pin #1 goes to the black primary winding of the transformer. Pin two goes to the Fuse. By shorting pins #1 & 2 you complete the circuit and enable AC voltage to be routed to the primary of the transformer.

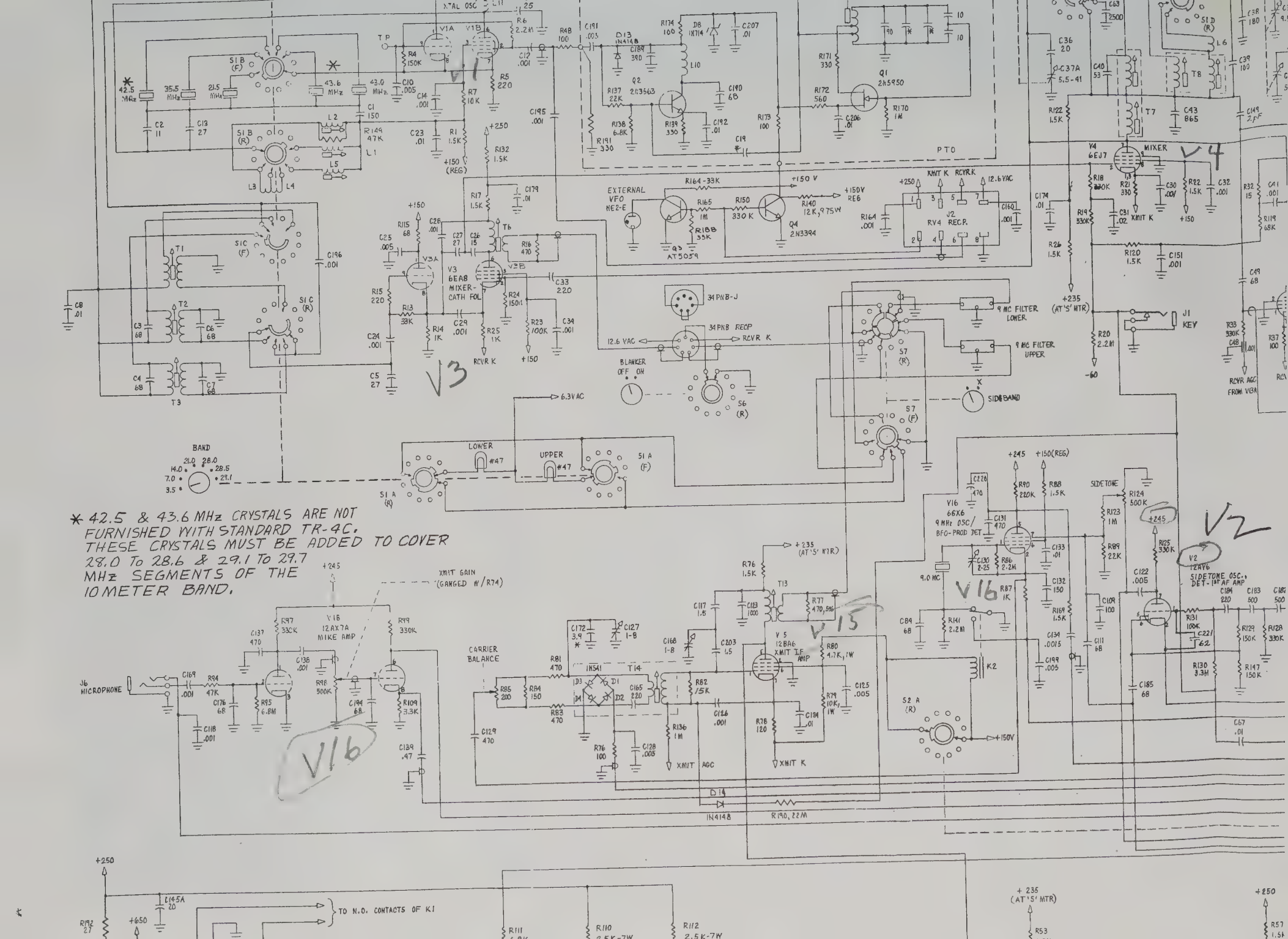


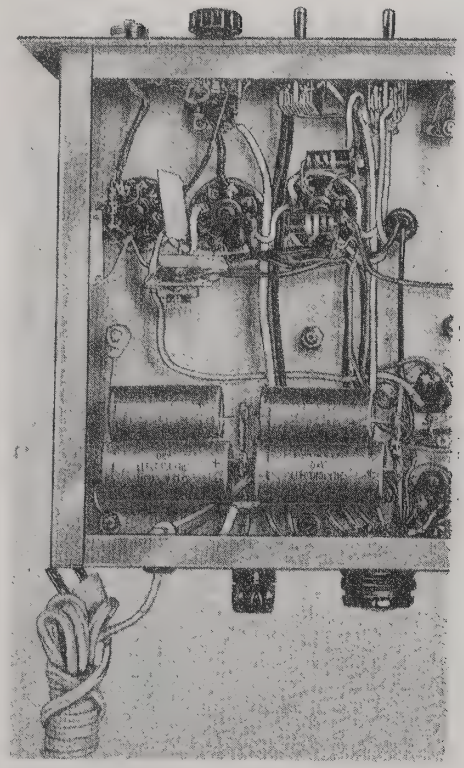
.5 & 43.6 MHz CRYSTALS ARE NOT
RNISHED WITH STANDARD TR-4C.
ESE CRYSTALS MUST BE ADDED TO COVER
0 To 28.6 & 29.1 To 29.7
z SEGMENTS OF THE
METER BAND.
V1 6EA8 PRE MIX, XTAL OSC
V3 6EA8 MIXER-CATH FOL
V15 12BA6 XMIT I.F AMP
V16 6GX6 9 MHz OSC/ BFO-PROD DET
V18 12AX7A MIKE AMP
V20 OA2
PTO
FSK
TUNING
EXTERNAL VFO NE2-E
Q1 2N5950
Q2 2N3563
Q3 AT5059
Q4 2N3394
J2 RV4 RECP.
XMIT K
RCVR K
34PNB-J
34PNB RECP
12.6 VAC
RCVR K
BLANKER OFF ON
S6 (R)
S7 (R)
S7 (F)
SIDEBAND
9 MC FILTER LOWER
9 MC FIL UPPER
BAND
21.0 28.0
14.0 28.5
7.0 29.1
3.5
S1 A (R)
S1 A (F)
LOWER #47
UPPER #47
6.3 VAC
XMIT GAIN (GANGED W/R74)
CARRIER BALANCE
+235 (AT 'S' MTR)
XMIT AGC
XMIT K
IN4148
R190, 22M
TO N.O. CONTACTS OF K1
PART OF R91
S5
XMIT AGC (FROM V13 B PLATE)
POWER SUPPLY RECP
J3
FIL. FUSE
+245
+150
+150 (REG)
V3
V18
V15

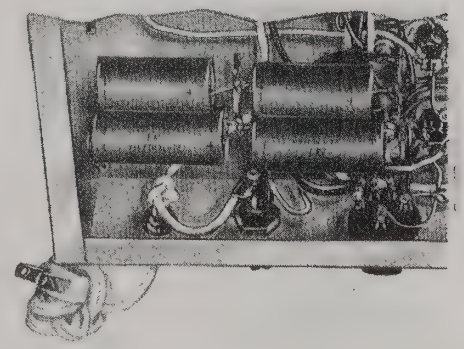




Bottom Vie


* 42.5 & 43.6 MHz CRYSTALS ARE NOT FURNISHED WITH STANDARD TR-4C. THESE CRYSTALS MUST BE ADDED TO COVER 28.0 To 28.6 & 29.1 To 29.7 MHz SEGMENTS OF THE 10 METER BAND.
V1
V2
V3
V4
V15
V16
PTO
MIXER
J6 MICROPHONE
CARRIER BALANCE
XMIT GAIN (GANGED W/R74)
SIDETONE
BAND
LOWER
UPPER
KEY
XMIT K
RCVR K
XMIT AGC
RCVR AGC FROM V6B
TO N.O. CONTACTS OF K1
+250
+245
+150(REG)
+235 (AT 'S' MTR)
+150V
-60
6.3 VAC
12.6 VAC
9 MC FILTER LOWER
9 MC FILTER UPPER
SIDEBAND
EXTERNAL VFO HE2-E
34PNB-J
34PNB RECP
RV4 RECP.
J2
J1
S1A (F)
S1A (R)
S1B (F)
S1B (R)
S1C (F)
S1C (R)
S1D (R)
S2 A (R)
S6 (R)
S7 (R)
S7 (F)
V1A 6EA8 XTAL OSC
V1B 6EA8 MIXER-CATH FOL
V3A 6EA8 MIXER-CATH FOL
V3B 6EA8 MIXER-CATH FOL
V4 6EJ7 MIXER
V16 6GX6 9 MHz OSC/ BFO-PROD DET
V16 12AX7A MIKE AMP
V5 12BA6 XMIT IF AMP
V2 12AY6 SIDETONE OSC., DET-1ST AF AMP
Q1 2N5950
Q2 2N3563
Q3 AT5059
Q4 2N3394
T1
T2
T3
T4
T5
T6
T7
T8
T13
T14
K2
D13 IN4148
D14 IN4148
D1 IN541
D2 IN541
D3 IN541
D4 IN541
D8 1N714
L1
L2
L3
L4
L5
L6
L10
42.5 MHz
35.5 MHz
21.5 MHz
43.6 MHz
43.0 MHz
BAND
21.0 28.0
14.0 28.5
7.0 29.1
3.5





Bottom Vi

Drake Mods - TR4 Mods/Technical

Authored by VE3EFJ

Tom Taylor, N7TM

9.2 TR4 MODS AND TECH

The changes or mods for this equipment are few. The tube line up changed a bit - different 100 kHz oscillator tubes and such, but for all practical purposes the radios performed about the same.

- TR4 Manual Trivia
  The front cover of the manual depicts the 2 crystal filters in the radio showing the skirt selectivity and bandwidth.

- Increase IF Gain
  The TR4Cw had 1 pf capacitors across the IF transformer hot side (T11 and T12) to increase the IF gain. Since bandwidth is determined by the crystal filter, this had no effect on the receiver.

- Different TX and RX Preselector Peaking
  Especially noticeable on 10 meters, its 'normal'. There is not much you can do about it.

- Sick Receiver
  In instances of a weak receiver or where the transceiver shows a very low sensitivity receiver after transmit, check the AC4 negative bias supply. This bias supply is used principally for final bias and receive AGC.

  In some cases, 'funny' receive AGC problems can be sourced to the 12AX7 AGC amplifier, but check the bias supply first.

- 9 MHz BFO
  Imagine the passband curves of the two sideband filters together as the capital letter 'M'. The BFO is set dead center in that middle valley between them. Proper setting of the BFO is to listen to the receiver with no antenna and switch the sideband selection, adjusting C130 for the same pitch. Sometimes you'll adjust it and 5 minutes later, the adjustment has drifted.

  In almost every case, this is caused by C130 losing its temperature characteristics. Two things will cause this - the ceramic has a hairline crack or there is crud in the trimmer.

  The following is not for the heavy handed ....

  All of these Centralab trimmers are held together from the bottom by a tripod clip that fits into a ring machined on the rotor shaft. Grab the long pin firmly with some needle nose (bottom chassis) and GENTLY pull and push down at the same time. At the same time, push very gently on the tripod clip with a small screwdriver just behind the center of the clip where you see the rotor pin . If you get this just right, the little ceramic disk on the top will fall out as the clip extracts. Don't apply so much force that the trimmer is smashed or, when the clip lets go the pliers run amuck.

  Now, inspect both inside surfaces for cracks. If its cracked, replace the trimmer. If it looks OK, clean both surfaces with alcohol and a fresh J-Cloth. Don't touch the surfaces! Oil from your fingers will ruin the repair and you'll be punished by having to do this over again.

  Now put it back together (heh heh).

removed from the receive stages and applied to the transmit stages. The antenna is changed from receive to transmit with a reed relay. There is a small time constant in the audio muting circuit to eliminate any clicks while keying. It is not long enough to interfere with the complete break-in operation of the Argonaut. The CW sidetone operates only when the mode switch is in the CW position.

The sidetone volume is independent of the front panel volume control. Volume may be set to the desired level with the printed circuit thumb potentiometer located on the audio power amplifier board. A finger access hole is provided in the bottom plate.

AUDIO

A jack is provided for an external speaker or headphones. When in use, the jack will automatically disconnect the internal speaker. The amplifier output was designed for an 8 ohm load, but will perform satisfactorily with high impedance phones or speakers with 4 to 16 ohms impedances.

ACCESSORIES

This socket gives access to the +12 volts, the audio line and the "t" voltage which is present only in the transmit mode. To maintain continuity of the audio channel, the dummy plug with jumper between pins 4 and 5 must be inserted. If Model 208 CW Filter is used, remove the dummy plug and insert cable from 208 into this socket.

PANEL LIGHTS

A slide switch is located on the rear of the unit to turn the panel lights on and off. This allows a minimum drain when the unit is operated from a battery supply.

FRONT PANEL CONTROLS

RF/AF CONTROLS

The RF gain controls the bias to the receiver rf amplifier. This is used primarily to reduce the susceptability to overload in the presence of extremely strong signals. The AGC will be dependent on the rf gain setting. The AF control controls the input to the power amplifier stage.

To minimize AGC popping, with RF fully clockwise, adjust the AF control setting while receiving a strong station to a level just a bit louder than desired. Then, control the level of this and all other stations to the desired level with the RF control.

MODE SWITCH

SB-N is the sideband normally in use on all bands. It will provide upper sideband on 20, 15 and 10 meters and lower sideband on 40 and 80 meters. The proper sideband is automatically selected by using either the sum or difference frequency in the mixer. The opposite or reverse sideband can be selected on the MODE switch, (SB-R), when needed.

The CW position connects the sidetone and disables the balanced modulator. The receiver is operated on the normal sideband. The transmitted signal is automatically offset 750 Hz from the received signal. This compensates for the BFO beat note and allows the transmitter to be on the frequency of the received signal.

Allow the radio to heat soak for 15 minutes with the top cover on and then adjust C130. I've done this a number of times over the years with these trimmers on various radios (NCX-5, most Heath). Oh yes - NEVER put a pencil mark on the side of these trimmers to indicate calibration. Guess where the graphite goes in about 3 months?

- C130 TR4Cw and TR4Cw/RIT
  The adjustment of the above trimmer is somewhat critical for proper CW reception, for the CW filter frequency is specifically designed for the 9 MHz BFO to be precisely on frequency. The sideband balance adjustment of C130 will affect the CW reception of the transceivers - the place where the note peaks to a *very* large degree.

  Be careful setting this BFO trimmer, for there is a filter match procedure to follow also. Without the filters properly loaded, the BFO adjustment using the 'hiss pitch' will be colored by a poor filter match setup.

- TR4any VOX Delay
  The TR4any has a fixed VOX delay. There is no adjustment for this delay; it has been set at the factory. The delay is about a second. The manual outlines a simple procedure for setting this delay to other than factory default. In most cases, the delay is about right.

- Antenna Fuse Bulb
  This is located inside the final cage and is a #12 bulb. A #12 is 6 volts at 150 ma - exactly the same as a #47, but with a different base. This bulb is a bit silly, for it will take well over a watt of RF to open it. By then, the receivers ruined anyway, most likely.

  If you really want this protection (its good Stupid Insurance), pull the bulb and put a Radio Shack peanut bulb (6 V at 50 ma or so) across the terminals. The cold resistance of this bulb will not affect the receiver adversely.

- TR4 Improved RX Audio
  On the TR4, C212, a .0015 uF on G1 of V17, a 6AQ5, should be paralleled with a .01 uF 300 volt cap. This will remove a lot of the brassyness and distortion.

  Following the TR4, Drake made some changes around the audio output stage, but they employed negative feedback to recover the frequency response of the sharp roll off of the coupling cap and grid resistor of V17.

- External Antenna Switch
  The switch on the side of the TR4 allows for an external antenna to be connected. Whenever you move the transceiver, the switch moves to external by mysterious cosmic forces. You connect the antenna and wonder why the receiver is dead. To prevent this, you can lock the switch by placing a 4-40 nut in the exposed slot where the tab slides back and forth. Cover the nut with some tape to prevent it

- Mixing Scheme - TR4any
  The TR4 uses the same PTO as the rest of the 4 line, but it has a 9 MHz IF. It covers 80 to 10 meters. Hetrodyne mixer crystals are not used on 80 or 20 meters. For these two bands, either the sum of the IF and PTO is used (20 meters) or the difference (80 meters). Thats why 20 meters has its unique dial markings that are backwards to the rest of the bands. All other bands have premix crystals and follow the formula of Fxtal = f + 9 + 5.5. The injection into the first mixer is 9 MHz ABOVE the lower band edge and is made up from the band crystal frequency MINUS 5. In the case of 80 meters, there is no crystal and the formula is simply f + 5.5. All crystals are HC/6U 3rd overtone. This is accurate for all bands but 80/20. In this case no crystal is used and the 5-ish MHz PTO is used directly. The 6EA8 PTO premix circuitry is diabolically ingenious in how it uses and does without a crystal oscillator depending upon the band switch.

  Having a TR4 operate on different bands is more of an operation than simply changing crystals. The front end is tuned by a variable capacitor, not by slug racks as in the case of the R4any.

  Moving a TR4 to the WARC bands, say 18 MHz in exchange for 20 cannot be done (no crystal,

The LOCK position is used for tune-up or antenna measurement purposes. It places the transmitter on the CW frequency and energizes the T/R circuits and antenna relay.

DRIVE CONTROL

This control determines the gain of the balanced modulator and is used to set the proper drive to the final amplifier. Overdrive on any band will not cause damage to the Argonaut. It will, however, result in an increased current drain for a given output. Excessive current, in turn, may result in chirpy CW signals and distorted SSB.

METER SWITCH

The meter may be used as an "S"-Meter or with the built-in SWR bridge. It has provision for reading both forward and reflected power. The switch is placed in the forward position and the transmitter is turned on. Set the meter to full scale with the DRIVE control. Switch to REV to read the standing wave ratio (SWR).

BANDSWITCH AND MAIN TUNING

The bandswitch selects the Amateur bands of 3.5, 7.0, 14.0, 21.0 and 28.0 MHz. It switches both the main VFO frequency and the transmitter/receiver tuned circuits.

The main tuning knob carries a dial skirt marked in 1 kHz increments up to 100 kHz. This scale is used in determining the frequency of operation within the 100 kHz segment noted on the slide rule dial pointer for all bands except the 28 - 30 MHz band. In this case, each marking represents 4 kHz and one complete rotation represents 400 kHz. On this band, the upper slide rule scale is used.

Since the VFO tuning shaft is raised from chassis potential to eliminate frequency jumping caused by poor sliding contacts, there is a small hand capacity effect on frequency when either the dial skirt or knob insert is touched. This effect is most pronounced on the 7.0 and 28 MHz bands due to oscillator tripling on these bands. To reduce the effect to negligible proportions, grasp only the plastic portion of the main tuning knob when fine tuning the VFO.

RESONATE CONTROL

The RESONATE control operates a mechanical assembly that permeability tunes the receiver rf amplifier circuits. This is all the tuning required when changing bands. The transmitter section does not require any adjustments.

OFFSET TUNING

The OFFSET control tunes the receiver independently of the transmitter. A push-pull switch is attached and the offset is disabled by pulling the knob out. It is more convenient to leave the offset control in operation and set to zero. It is then instantly available when needed. The circuitry is stable and should not change frequency. The zero is checked by turning the offset on and off and no change in the frequency of the received signal should be noticed.

Due to a residual small voltage being present across the OFFSET control when OFFSET is disabled, a very slight frequency shift may be noticed when rotating the control between its extremes. This is a normal condition and of no consequence due to the small magnitude of the variation.

remember?). Generally, what you see is what you're going to have.

- What Happened to 15 Meters?
  There is no 15 meter adjustments in the radio aside from the band crystal. Make sure you place the preselector where the manual tells you to during alignment of the various bands.

  If you inspect the band switch, you'll see some small air wound coils about 1/4" in diameter. These coils are used for the three 10 meter crystal oscillators and for 15 meters. Now that you know this, that does not give you an excuse to muck with them if you have trouble in these areas. Those coils have sat there for 20 years. If you have trouble in any of these areas in your radio, it will never, ever be with these coils.

- Low Sensitivity 40, 15 or 10 Meters
  First, check for sensitivity on 20 meters. Is it OK?

  What you've just done is verify that the front end is just fine and that the problem is in the VFO premixer - the 6EA8. Quite often people will twiddle the transceiver - see "15 Meter Osc Inj" on the coil can and tune for max S meter. This is OK, but they forget that there is a similar slug on the bottom of the coil can too. Of course one slug affects the other.

  And, again, you needn't bother with the loading network.

- Relay Cycling
  Especially on the transceivers, sometimes when you put the unit in TUNE, it will drop out or cycle as you advance the DRIVE control. Nothing is wrong - its caused by having the RX audio set too high in relation to the anti VOX. Its actually the sidetone signal thats doing it. Turn down the audio gain, pull the mic or adjust the antivox.

  Another cause of relay cycling can be the filter can as mentioned in the general comments section.

- Relay Specifications
  The relay changed from year to year, from open frame to enclosed, depending upon the model of the transceiver, but the relay coil specifications did not. The relay is 120 volt and 15,000 ohm coil.

  What if I can only find a 120 VAC relay? Measure the resistance and if its 12K to 18K, use it. In most cases, AC relays are the same as the DC relays except for a shorting turn. In all likelihood you can use one and never notice the difference.

- Ventilation
  All Drake vaccuum tube equipment that transmits should be placed in such a way that adequate air flow is provided. This is especially true for the transceivers. If there is adequate airflow, you'll find Drake equipment to be quite gentle on components. Conversely, if you choke a TR4 off from free air circulation, you'll eventually cook the components. The first to go usually are ceramic disk capacitors.

  If you have to replace more than one or two of these, it is a sure sign that someone cooked the radio.

- Fan
  The PA cage area gets quite hot when in use and some forced air cooling is desirable. There is quite a lot of heat trapped in that final cage that is trying to escape by convection. The answer is a fan, not so much for cooling, but to help purge the hot air inside the final cage.

  The only place to mount a fan is on the back of the final cage. A small 12 volt 70 ma 2 1/4" fan just fits nicely. If you route the leads through one of the corner chassis holes, they will come out in the final compartment. You can pick off the 12 VAC from the junction of the feed through and the filament choke. Do not go to the final tube filament pins - they are RF isolated by the chokes. Power the fan from a half wave rectifier filtered with about 100 uF at 20 volt. This mod can be done without drilling any holes or destroying the units originality. Orient the fan to blow in. I use a larger fan on the TR4 than a T4any simply

CALIBRATION AND WWV RECEPTION

The broadcasts of WWV and WWVH may be received on 15 MHz by the following tuning procedure.

1.) Set the band switch to 21.0 MHz.

2.) Turn the slide rule dial and the frequency readout dial to zero.

3.) Tune the RESONATE control to an area between 3.5 and 7.0 MHz. By tuning RESONATE and the frequency readout dial, WWV will be heard if the band is open.

4.) Tune the frequency readout dial until the receiver zero beats with WWV.

5.) Set the aluminum dial to zero. It may be necessary to hold the black tuning knob when turning the readout dial.

6.) This calibrates the 21 MHz band only.

To calibrate all bands, Model 206 Crystal Calibrator can be inserted into the antenna line. This calibrator provides check points every 100 kHz, and the signal is pulsed for easy identification.

GENERAL OPERATING NOTES

1.) When the METER switch is set to the S MTR position, incoming signal strength can be determined, provided the rf gain control is advanced to maximum.

2.) The S-Meter will deflect to full scale in the transmit mode. This is normal.

3.) The RESONATE control should be re-peaked whenever the operating frequency is changed by approximately 50 kHz or more on the low frequency bands.

4.) When changing bands, or going to the opposite ends of the 80 meter band, the DRIVE control should be reset so as to maintain maximum output without overdrive.

5.) Although improper antenna will not damage the Argonaut, we suggest careful tune-up for maximum performance.

6.) In CW transmit mode, the carrier is automatically offset by 750 Hz. In so doing, the transmitted frequency is exactly the same as the received signal, (assuming OFFSET control is in center position or defeated), when the received signal is tuned to provide a 750 Hz beat note.

7.) In SB-R mode, the dial calibration will be off by approximately 2.5 kHz due to carrier oscillator shift. If accurate calibration is desired in this mode, it is suggested that a crystal calibrator be used and the dial skirt re-zeroed.

8.) In mobile operation, start the engine before turning transceiver on.

9.) The VFO in the Argonaut, like any LC oscillator, is adversely affected by stray ac magnetic fields cutting the coil winding. The oscillator output becomes frequency modulated at the line frequency, or some multiple of it, causing a "dirty" CW note and/or poor quality audio in both receive and transmit modes. When installing the transceiver, locate any ac operated equipment that may generate these fields as far as practical from the Argonaut. Power supplies, electric clocks, keyers, rotator control boxes are common sources of trouble.

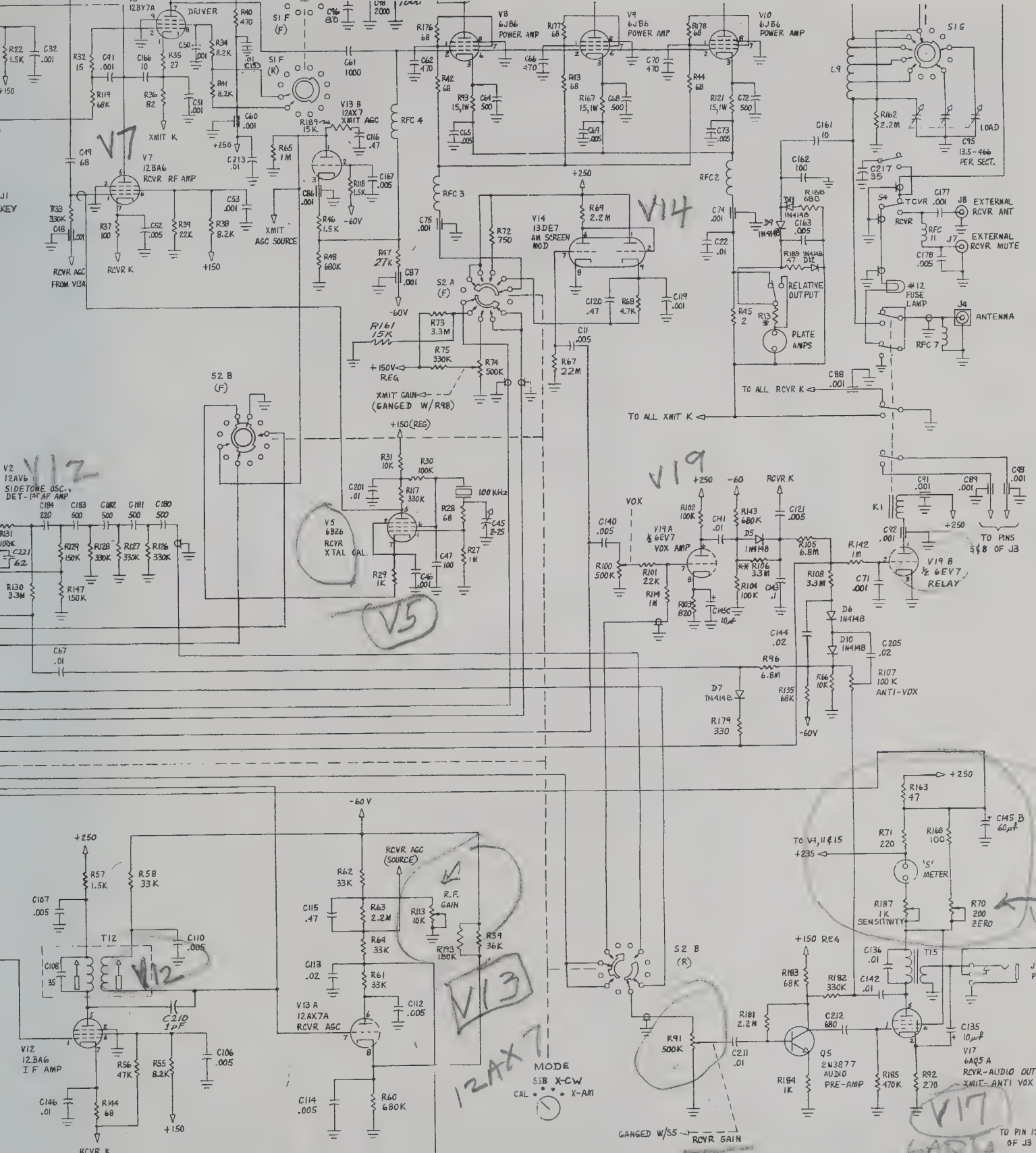
Since the VFO is located front and center, the most common cause of FMing is the placing of such accessories on top of the Argonaut. A check of the purity of a received CW signal should be made at the time of installation.

Table 5–1. Resistance Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	9.5 K	2.5 Meg	20 K	0	Fil	9.6 K	220	220	150 K
V2	12AV6	3.3 Meg	Inf.	Fil	0	150 K	150 K	350 K	—	—
V3	6EA8	8.0 K	150 K	250 K	Fil	0	11 K	2.2 K	1 K	34 K
V4	6EJ7	25 K	660 K	23 K	Fil	0	0	11 K	9.5 K	0
V5	6BZ6	1 Meg	1 K	Fil	0	350 K	125 K	1 K	—	—
V6	12BY7A	25 K	67 K	0	0	0	Fil	8.5 K	25 K	0
V7	12BA6	2.8 Meg	0	Fil	0	11 K	10K	100	—	—
V8	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V9	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V10	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V11	6BZ6	2.5 Meg	150	0	Fil	10 K	13 K	0	—	—
V12	12BA6	2.5 Meg	0	Fil	0	10 K	13 K	68	—	—
V13	12AX7	1 Meg	22 K	45 K	0	0	2.2 Meg	55 K	48 K	Fil
V14	13DE7	8 K	2.5 Meg	2.5 Meg	Fil	0	2.2 Meg	22 Meg	0	Inf.
V15	12BA6	2 Meg	0	0	Fil	10 K	13 K	25 K	—	—
V16	6GX6	2.2 Meg	1 K	0	Fil	250 K	9.2 K	22 K	—	—
V17	6AQ5	500 K	270	0	Fil	8.7 K	8 K	500 K	—	—
V18	12AX7	350 K	6.8 Meg	0	0	Fil	350 K	500 K	3.3 K	N. C.
V19	6EV7	13 K	4.5 Meg	0	Fil	0	110 K	450 K	820	1.5 Meg
V20	OA2	7.8 K	0	Inf.	0	7.8 K	Inf.	0	—	—

REF DES	Transistor Type	MEASURED AT:		
		Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	5.6 K	43 K
Q4	2N3394	0	750	1.1 K
Q5	2N3877	1 K	56 K	6.8 K

NOTE:
All measurements were made with respect to ground with the power supply disconnected from the TR–4C. The BAND switch was on 7.0 MHz, the Mode switch was on CAL and the RCVR GAIN and XMTR GAIN controls were fully clockwise. The VOX, ANTI VOX and SIDETONE controls were fully clockwise and the ZERO control was set at the balance point. The accessory 34–PNB jumper plug was in the noise blanker jack.



NOTES

1. ALL ROTARY SWITCHES SHOWN IN EXTREME CCW POSITION.
2. ALL RESISTORS IN PTO ARE ¼ WATT, ALL OTHERS ARE ½ WATT, 10%, EXCEPT WHERE NOTED OT
3. CAPACITOR VALUES FROM 1 TO 1000 ARE IN pf, & THOSE FROM .001 AND UP ARE IN µf.
4. HIGHEST RESISTOR R193
5. HIGHEST CAPACITOR C202

* VALUE SELECTED IN PRODUCTION.
** ADJUST TO CHANGE VOX HOLDING TIME.
*** FILAMENT FUSE IS A 1½" LENGTH OF #26 TINNED WIRE

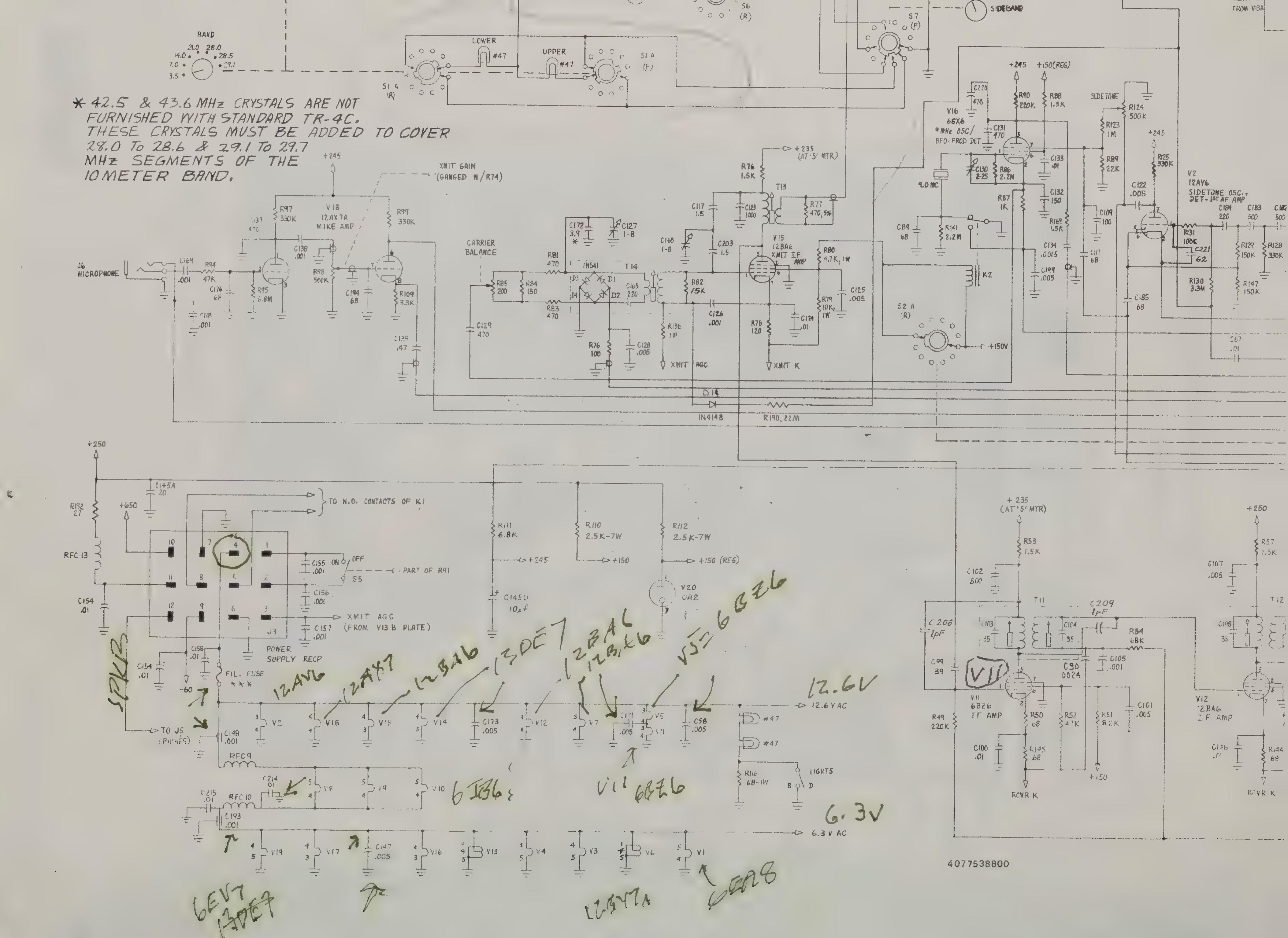
Figure 5–5. TR–4C Schema

BLUE PANEL
BALO MAIN ENCLOSURE

HAMMARLUND

Table 5–2. Voltage Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	122	–2	125	0	6.3*	250 245	2.6	2.6	–1.3
V2	12AV6	0 –1.6	13.0 0	12.6*	0	0 0.9	0 0.9	255 122	—	—
V3	6EA8	155 150	0	98 150	6.3*	0	260 250	3.5 150	17 15.5	17 15.2
V4	6EJ7	155 2.8	0	NC	6.3*	0	0	270 230	175 145	—
V5	6BZ6	–42 0	0.9 23	12.6*	6.3*	70 140	58 144	0.9 23	—	—
V6	12BY7A	155 3.3	0	NC	0	0	6.3*	265 240	262 165	0
V7	12BA6	–.14	0	12.6*	0	235 230	98 110	1.25 150	—	—
V8	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V9	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V10	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V11	6BZ6	–.16	1.6 150	0	6.3*	235	125 150	0	—	—
V12	12BA6	–.16	0	12.6*	0	240	105 150	1.1 150	—	—
V13	12AX7	–.1 0	–61 –61	–59 –59	0	0	–.16	–61 –61	–59 –58	6.3*
V14	13DE7	260 250	11.4 11.2	11.4 11.2	12.6*	0	11.4 11.2	–1.0 –1.0	0	64 53
V15	12BA6	0	0	0	12.6*	248 140	155 144	155 1.3	—	—
V16	6GX6	–6.0 –5.6	4.0	0	6.3*	140 140	140	0	—	—
V17	6AQ5	0	7.2 6.8	0	6.3*	240 230	155 150	NC	—	—
V18	12AX7	88 87	–.75	0	0	12.6*	130 125	0	1.23 1.1	NC
V19	6EV7	260 180	–6 –.36	0	6.3*	0	103 110	0	1.25 1.20	TP
V20	OA2	146	NC	NC	NC	NC	NC	0	—	—


* 42.5 & 43.6 MHz CRYSTALS ARE NOT FURNISHED WITH STANDARD TR-4C. THESE CRYSTALS MUST BE ADDED TO COVER 28.0 To 28.6 & 29.1 To 29.7 MHz SEGMENTS OF THE 10 METER BAND.
BAND
LOWER
UPPER
SIDEBAND
J6 MICROPHONE
V18 12AX7A MIKE AMP
XMIT GAIN (GANGED W/R74)
CARRIER BALANCE
V15 12BA6 XMIT IF AMP
V16 6GX6 9 MHz OSC/ BFO-PROD DET
V2 12AY6 SIDETONE OSC., DET-1ST AF AMP
SIDE TONE
XMIT AGC
XMIT K
TO N.O. CONTACTS OF K1
PART OF R91
XMIT AGC (FROM V13 B PLATE)
POWER SUPPLY RECP
FIL. FUSE
TO J5 (PHONES)
V20 OA2
LIGHTS
12.6 V AC
6.3 V AC
V11 6BZ6 IF AMP
V12 12BA6 IF AMP
RCVR K
4077538800

DISASSEMBLY

1.) REMOVAL OF TOP

Remove the two screws at the extreme edges of the rear of the top. Slide the top back and out of the grooves in the side panels. It is recommended that the speaker wires be disconnected from the speaker to eliminate any possibility of damage during service.

2.) REMOVAL OF BOTTOM PLATE

Remove the four screws in the bottom plate. Slide the bottom back and out of the grooves in the side panel.

This should be sufficient for any alignment necessary on the circuitry.

3.) FRONT PANEL REMOVAL

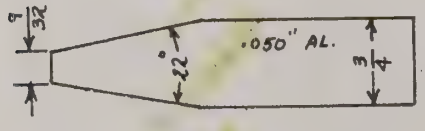
Dial cord, pilot light and switch linkage are behind the front panel.

Remove the knobs and dial skirt. It is a friction fit to the VFO shaft and can be removed by pulling away from the front panel. Remove the four screws in the bottom of the front panel. Loosen one side panel "Z" bracket. The "Z" brackets are located at the top of each side panel and are secured to the sub-panel. Carefully lift the front of the side panel and slip out the front panel.

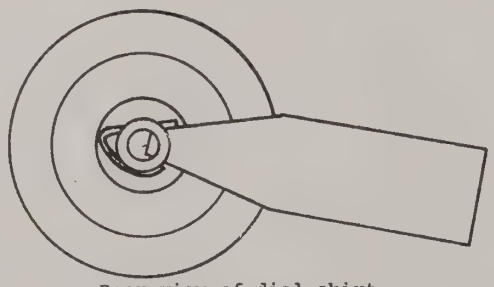
4.) DIAL SKIRT REMOVAL AND REPLACEMENT

The main tuning dial skirt is friction mounted to the shaft and can be easily removed by pulling it straight off the shaft after the plastic knob is removed. The felt washers between knob and skirt provide a slight amount of friction to eliminate any backlash between the two.

To replace the dial skirt, either a specially constructed tool as shown below, or a screwdriver with a blade width of approximately 9/32" can be used. With the tool, spread the "D" spring on the skirt hub so that the straight portion does not show through in the hub bore. If the tool tip shows in the bore, this is OK for now. Start the skirt on the shaft, with the tool handle pointing downward in relation to the front panel. This puts the handle of the tool out in the open. Push the skirt on the shaft until the tip of the tool in the hub bore hits the brass portion of the two diameter shaft. While maintaining inward pressure on the skirt, slowly remove the tool from the groove by using a rotational motion on the handle. As the tip is pulled from the hub bore, it will allow the skirt to be pushed on the shaft before the spring can regain its unstressed condition. Seat the skirt as far as it will go.



Dimensional details of insertion tool.



Rear view of dial skirt with tool inserted.

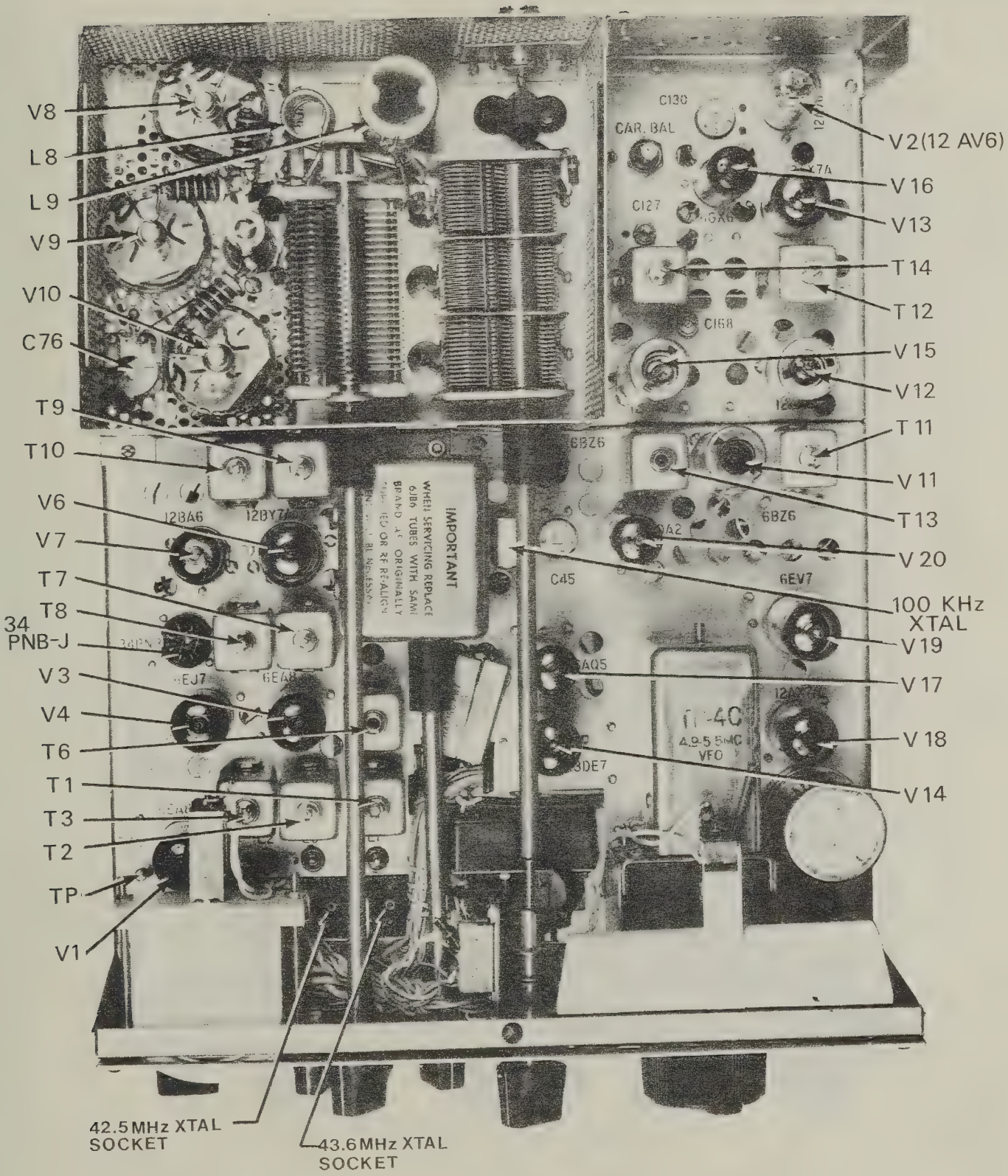


Figure 5–1. Alignment Locations, Top View

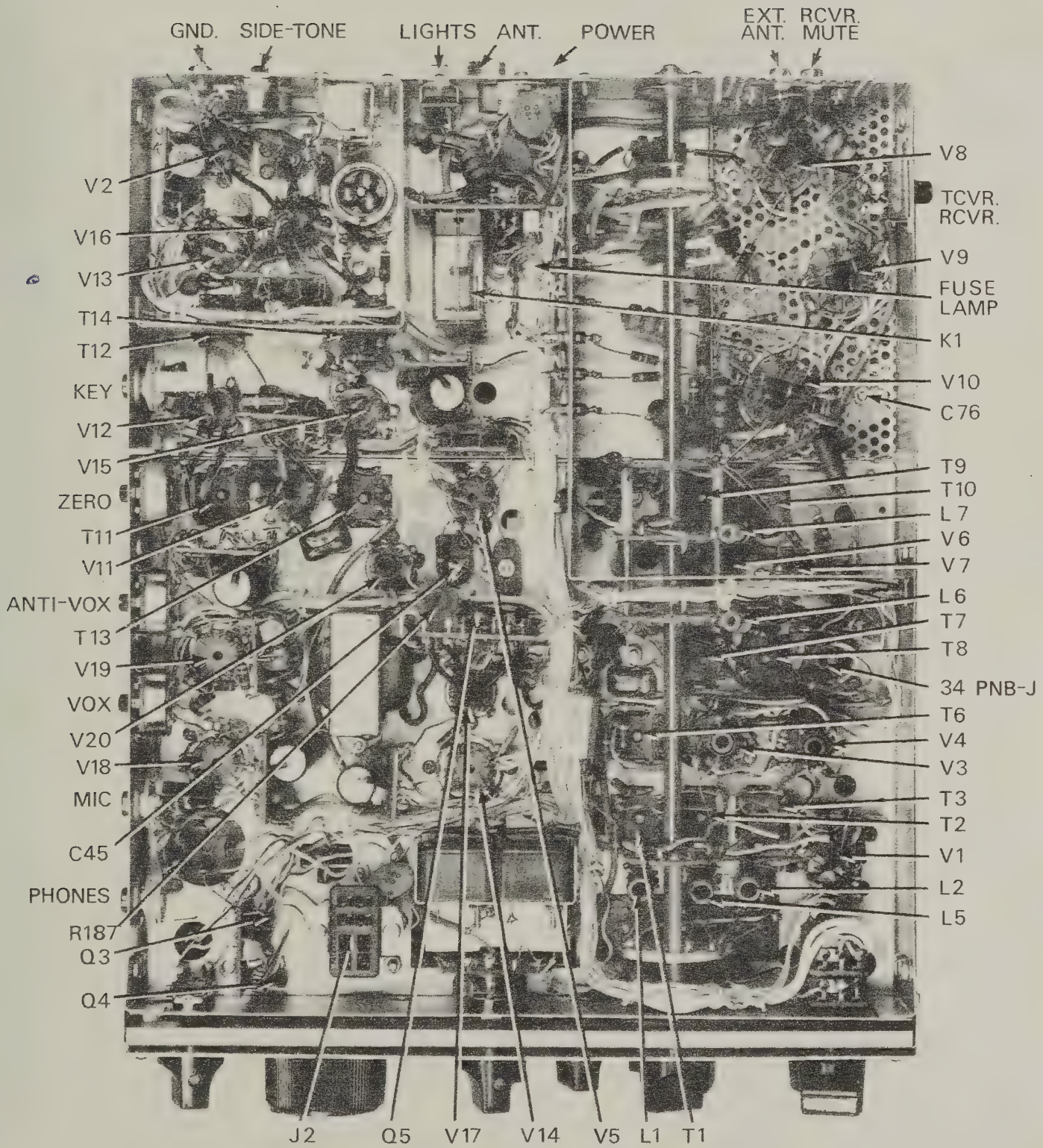


Figure 5–2. Alignment Locations, Bottom View

Table 5–2. Voltage Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	122	–2	125	0	6.3*	250 245	2.6	2.6	–1.3
V2	12AV6	0 –1.6	13.0 0	12.6*	0	0 0.9	0 0.9	255 122	—	—
V3	6EA8	155 150	0	98 150	6.3*	0	260 250	3.5 150	17 15.5	17 15.2
V4	6EJ7	155 2.8	0	NC	6.3*	0	0	270 230	175 145	—
V5	6BZ6	–42 0	0.9 23	12.6*	6.3*	70 140	58 144	0.9 23	—	—
V6	12BY7A	155 3.3	0	NC	0	0	6.3*	265 240	262 165	0
V7	12BA6	–.14	0	12.6*	0	235 230	98 110	1.25 150	—	—
V8	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V9	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V10	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V11	6BZ6	–.16	1.6 150	0	6.3*	235	125 150	0	—	—
V12	12BA6	–.16	0	12.6*	0	240	105 150	1.1 150	—	—
V13	12AX7	–.1 0	–61 –61	–59 –59	0	0	–.16	–61 –61	–59 –58	6.3*
V14	13DE7	260 250	11.4 11.2	11.4 11.2	12.6*	0	11.4 11.2	–1.0 –1.0	0	64 53
V15	12BA6	0	0	0	12.6*	248 140	155 144	155 1.3	—	—
V16	6GX6	–6.0 –5.6	4.0	0	6.3*	140 140	140	0	—	—
V17	6AQ5	0	7.2 6.8	0	6.3*	240 230	155 150	NC	—	—
V18	12AX7	88 87	–.75	0	0	12.6*	130 125	0	1.23 1.1	NC
V19	6EV7	260 180	–6 –.36	0	6.3*	0	103 110	0	1.25 1.20	TP
V20	OA2	146	NC	NC	NC	NC	NC	0	—	—

over

Table 5–2. Voltage Chart (continued)

REF DES	Transistor Type	MEASURED AT: Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	0	61
Q4	2N3394	0	11.2	0
Q5	2N3877	2.3	2.8	48

NOTE:
All measurements were made with an 11 Megohm VTVM and were taken from ground. RF TUNE, PLATE and LOAD controls were set as described in paragraph 3-7. BAND switch was on 7.0 MHz, VFO dial was at 7.250 MHz and SIDEBAND was on X. Receive measurements were made with the Mode switch in the CAL position and the transmit measurements were made with the Mode switch in the X-CW position, with the following exception:

On V14, both receive and transmit measurements were made with the Mode switch in the X-AM position and with PTT line grounded.

The AC–4 Power Supply was used. Where two voltages are shown, the top is for receive and the bottom is for transmit. An "*" indicates AC voltage. The accessory 34–PNB jumper plug was in the noise blanker jack.

5-13. RECEIVER IF.

a. Peak the RF TUNE control on noise at 3.8 MHz.
b. Adjust T11 top and bottom and T12 top and bottom for maximum noise from the speaker.

5-14. BALANCED MODULATOR AND CARRIER BALANCE.

a. Disconnect the power supply and reconnect the screen and plate supply leads to the final amplifier tubes.
b. Reconnect power supply.
c. Connect dummy load to the antenna jack.
d. Peak the RF TUNE control for maximum receiver gain.
e. Adjust bias per paragraph 3-6. With XMIT GAIN fully counterclockwise, place the Mode switch in X–CW position and SIDEBAND switch in X position.
f. If the plate current exceeds 0.15 Ampere, adjust the RF TUNE for 0.15 Ampere maximum.
g. If plate current is less than 0.15 Amperes, adjust Carrier Balance pot until plate current reaches 0.15 Amperes.
h. Peak T14 for maximum plate current. Detune the RF TUNE control to prevent plate current from exceeding 0.15 Amperes.
i. Alternately adjust the Carrier Balance control and C127 for minimum plate current. There should be no difference in plate current between the two positions of the SIDEBAND switch.

IX AC-3 POWER SUPPLY

The R. L. Drake model AC-3 is a complete power supply capable of supplying all of the required voltages for the TR-3 with the proper filtering and regulation from 120 VAC, 50/60 cycles.

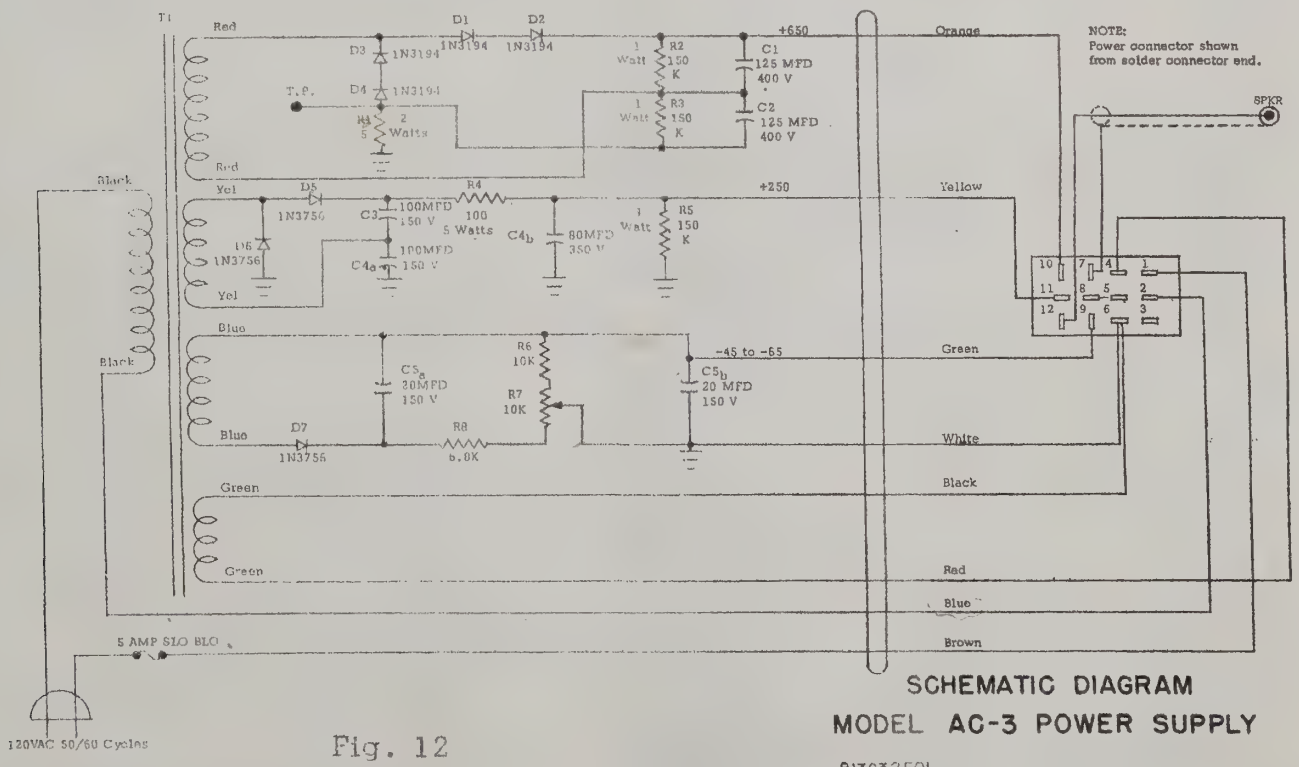
It is designed to fit into either our model MS-3 matching speaker or RV-3 receiving VFO/speaker to become a single unit.

To mount it in either of these units, remove the four rubber feet from the bottom and slide it in from the rear so that the line cord and power cable face outward. Fasten it in place with the four screws which were used to hold the feet on.

To connect it to the TR-3, simply plug the female power connector on the end of the power cable into the male connector on the rear of the TR-3 (See TR-3 installation instructions).

The bias adjustment should be set properly before any operation is attempted. (See TR-3 tune up instructions). A test point is provided for ease in measuring final amp. plate current. This current in amperes is equal to the voltage at this point times 0.2. To properly set the bias voltage for 0.1 ampere idling current in the TR-3 the voltage at this point should read 0.5 volts.

IMPORTANT: NEVER SHIP THE AC-3 MOUNTED INSIDE THE MS-3 OR RV-3 CASE OR SERIOUS DAMAGE TO THE CASE WILL RESULT.



SCHEMATIC DIAGRAM
MODEL AC-3 POWER SUPPLY

913632501

Fig. 12

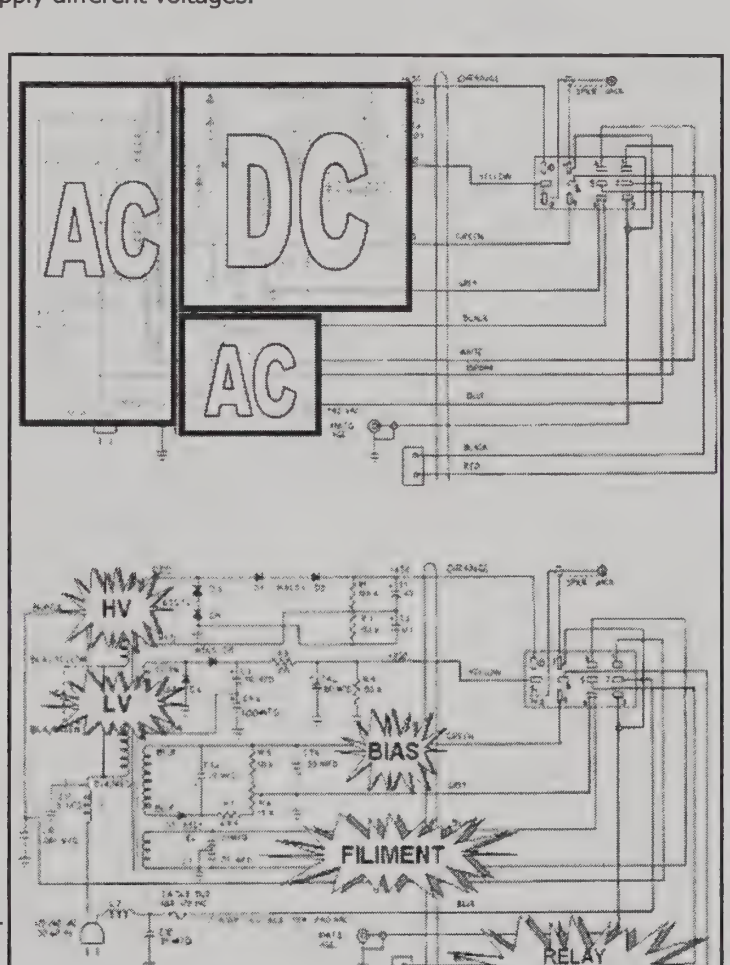
Drake Home Page Drake Technical Tips Menu

AC4 / AC3 POWER SUPPLY TROUBLE SHOOTING

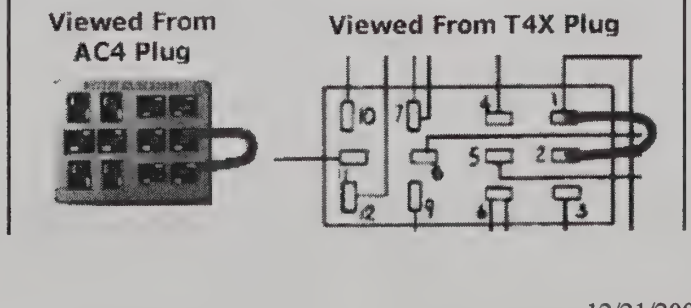
By: Mark Gilger, WB0IQK

In the following procedures you will be close to dangerous high voltages. Be careful.

- The first of the procedures has you verify the voltages at the connector. The second requires you to remove the bottom cover for further testing. The second parts is only required if indicated by the results of the first.
- The AC4/AC3 can be divided up into AC and DC sections as pictured below.
- The supply also has 4 separate sections that supply different voltages.



- The High Voltage (HV) section supplies approximately +650 volts used by the tube final amplifier section.
- The Low Voltage (LV) supplies approximately +250 volts to most other sections of the radio.
- The Bias supply, supplies the needed negative (-) bias voltage to the amplifier sections.
- Last is the filament supply. This supplies the needed AC voltage to all of the tubes in the radio.
- The supply also routes the transmitter ALC and amplifier relay keying voltage to plugs on the rear of the AC4/AC3 for use by a remote amplifiers.
- Unplug the supply from the outlet.
- In order to get the AC4/AC3 powered up, we need to simulate the power on/off switch inside of the radio. This requires us to short pins #1 & 2 together with a jumper. Use the figure below to following the circuit. Pin #1 goes to the black primary winding of the transformer. Pin two goes to the Fuse. By shorting pins #1 & 2 you complete the circuit and enable AC voltage to be routed to the primary of the transformer.
- Plug the positive (+) lead of your DC volt meter into pin #10 on the connector. This is the High Voltage +650 Volts DC. Make sure you set the meter up to read >650 Volts DC.
- Hook the negative (-) test of your DC volt meter to the supply chassis.
- When performing the following step, make sure that if you do not see a voltage within several seconds, you unplug the supply immediately.
- In each of the following steps, you can choose to unplug the supply after each step. This will prevent damage to components while you are



checking other sections. If you have 3 volt meters that can be hooked up at the same time, you can make sure all 3 voltages are present to make sure damage does not occur.

- In each of the following steps, you can choose to unplug the supply after each step. This will prevent damage to components while you are checking other sections. If you have 3 volt meters that can be hooked up at the same time, you can make sure all 3 voltages are present to make sure damage does not occur.

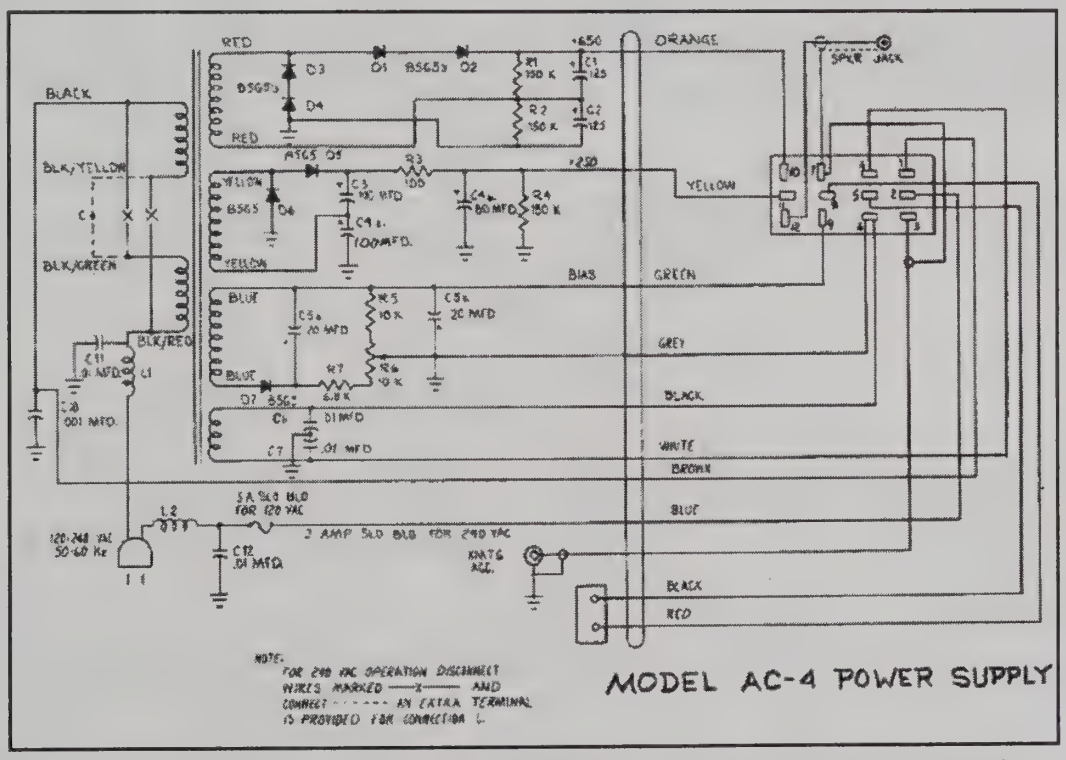
- Plug the supply into the AC outlet. Verify there is DC voltage present. It should be in the mid +650 volt DC range. If it looks ok, turn your meter to AC and verify you have very minimal AC voltage present. This AC reading should be less than 2 volts.

- Move your positive lead to pin #11 and verify you have +250 volts, with less than 1 volt AC.

- Reverse your positive and negative leads by moving your (+) lead to the chassis ground.

- Move your negative (-) lead to pin #9 and verify you have negative -20 to -60 volts present with less than a half volt AC present This is your bias voltage and can be adjusted by turning potentiometer R6 located on the front of the AC4.

- Turn your meter to AC and put either lead in pin #6 and pin #4. You should read around 12-14 volts AC. This is the filament supply voltage.



- The reason for checking the AC component of the DC supplies is to verify the filter capacitors are doing their job. If the filter cap is open, a high AC ripple will be noted and will cause a hum to be noted on the transmit signal. Especially so in the 250 volt supply.

- If a problem is noted in any of the above steps. Unplug the unit from the AC outlet.

- Remove the 10 screws securing the bottom cover.

- Use the following pictures to help locate components.

- Note any burnt components and replace.

- If one of your supplies had a low voltage, the problem could be a bad diode. It's easier to just replace them all than

trying to isolate which one is bad. Radio shack sells a good replacement, it's their catalog number 276-1114. It's a 2.5 amp 1000 volt rectifier diode. A 1N4007 in addition to many more work just fine.

- Resistor R3 is often the culprit in the 250 volt section. It is susceptible to over heating, which causes it to open up resulting in no, or very little voltage output.

- The most troublesome problem is the filter capacitors failing. They dry out or start leaking and can cause damage when they fail. Inspect around the base of each of the 5 filter capacitors for leakage. If any is noted, replace.

- Unplug the AC4 and let it sit for several minutes before proceeding. Put your meter in the resistance mode.

- Put the negative lead on the chassis ground and the positive lead on each post of each capacitor. The meter should show a high resistance. The meter movement should start showing the resistance moving down scale (getting smaller) as the capacitor uses the internal meter's battery to charge it up. This indicates the filter capacitor is not shorted, or opened, and might be ok.

- If when checking, the meter does not indicate the discharging of the capacitor in the above step, replace it.

- If the meter shows a very low resistance, the capacitor is shorted and needs to be replaced.

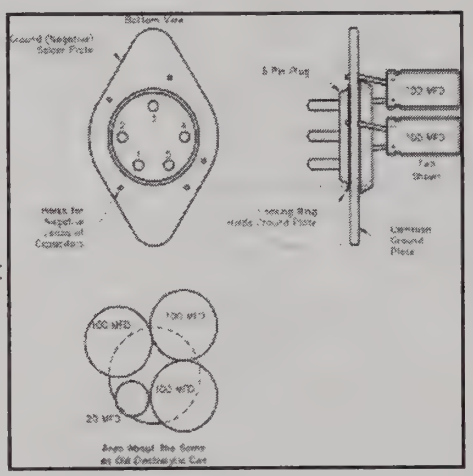
- If the meter shows a high resistance, and does not discharge, it indicates the capacitor is open.

- Any of these indicate the capacitor needs to be replaced.

- Replacement capacitors for theAC4/AC3 are no longer available. The easiest way to replace defective sections is to clip the post off of the effected defective capacitor and then solder a replacement to that removed post.

- Wrap this solder point in electrical tape to prevent it from later shorting to ground.

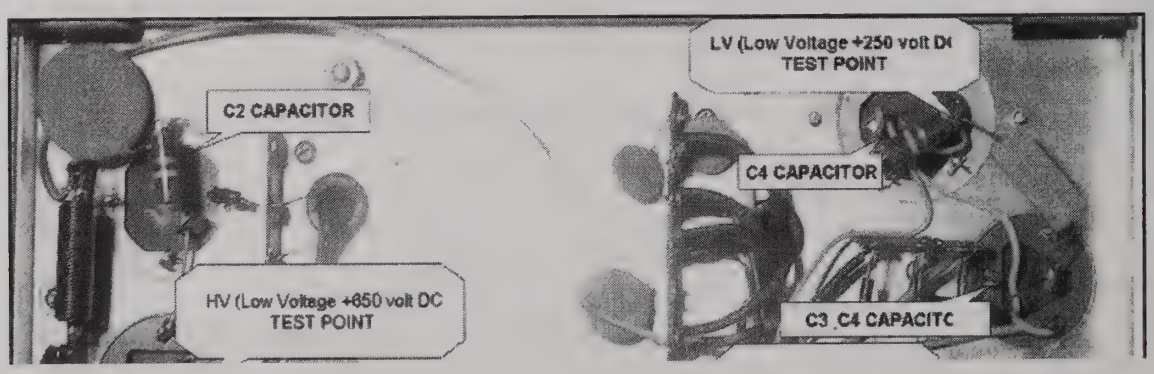
- An alternative to this method is outlined in Technical Information Exchange #10, written by Daniel, W6SPC. It covers replacing defective R4 filter caps, but it can be easily applied to the AC4/AC3 unit. The general idea is shown here.

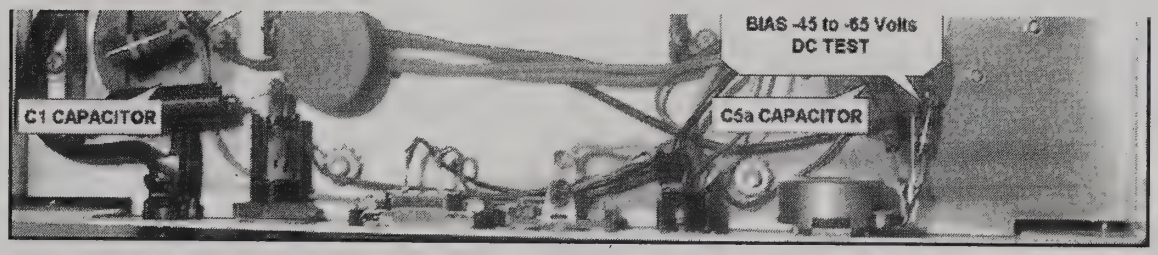


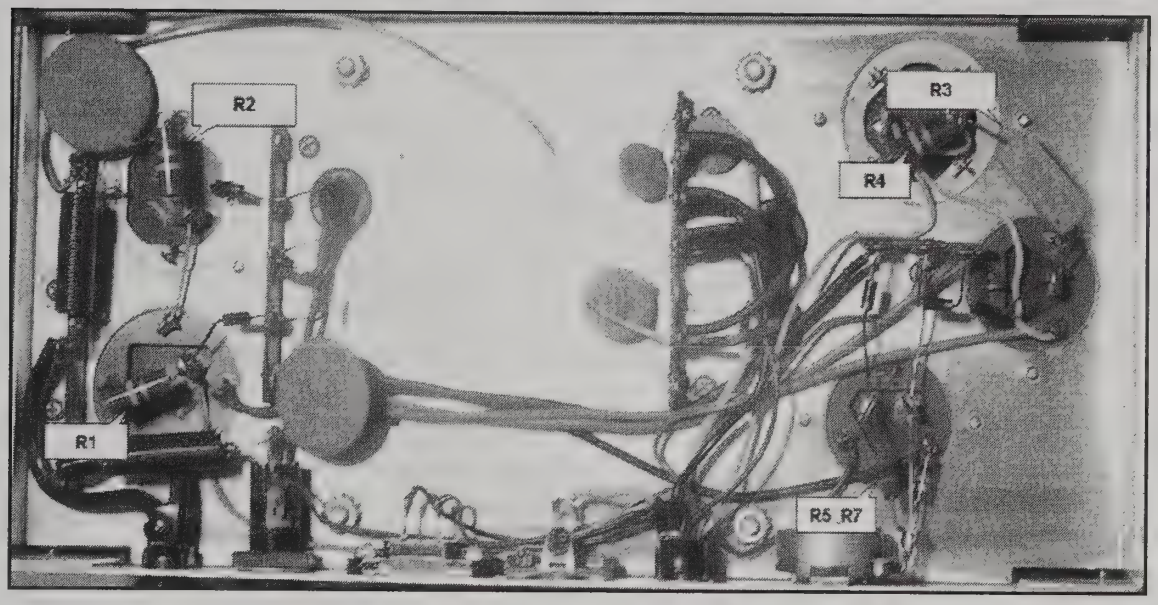
Several things to note:

1. The AC4 and AC3 are almost identical and can be interchanged for use on any Drake radio requiring one or the other.

2. The most notable difference is the AC3 is open frame, where the AC4 has an RFI protective cover.




BIAS -45 to -65 Volts
DC TEST
C1 CAPACITOR
C5a CAPACITOR


R2
R3
R4
R1
R5 ,R7

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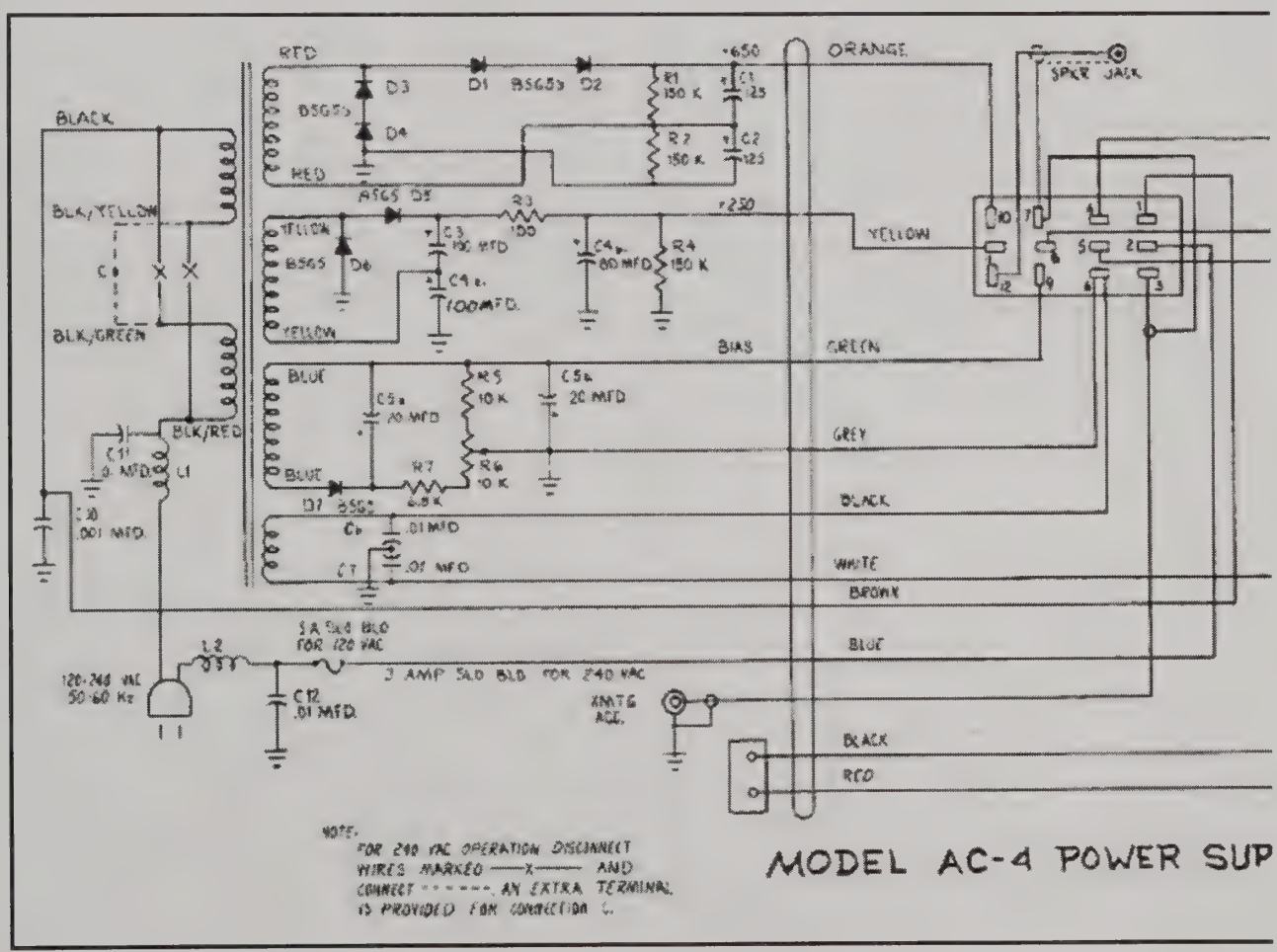


- The reason for checking the AC component of the DC supplies is to verify the filter capacito doing their job. If the filter cap is open, a high AC ripple will be noted and will cause a hum to l on the transmit signal. Especially so in the 250 volt supply.

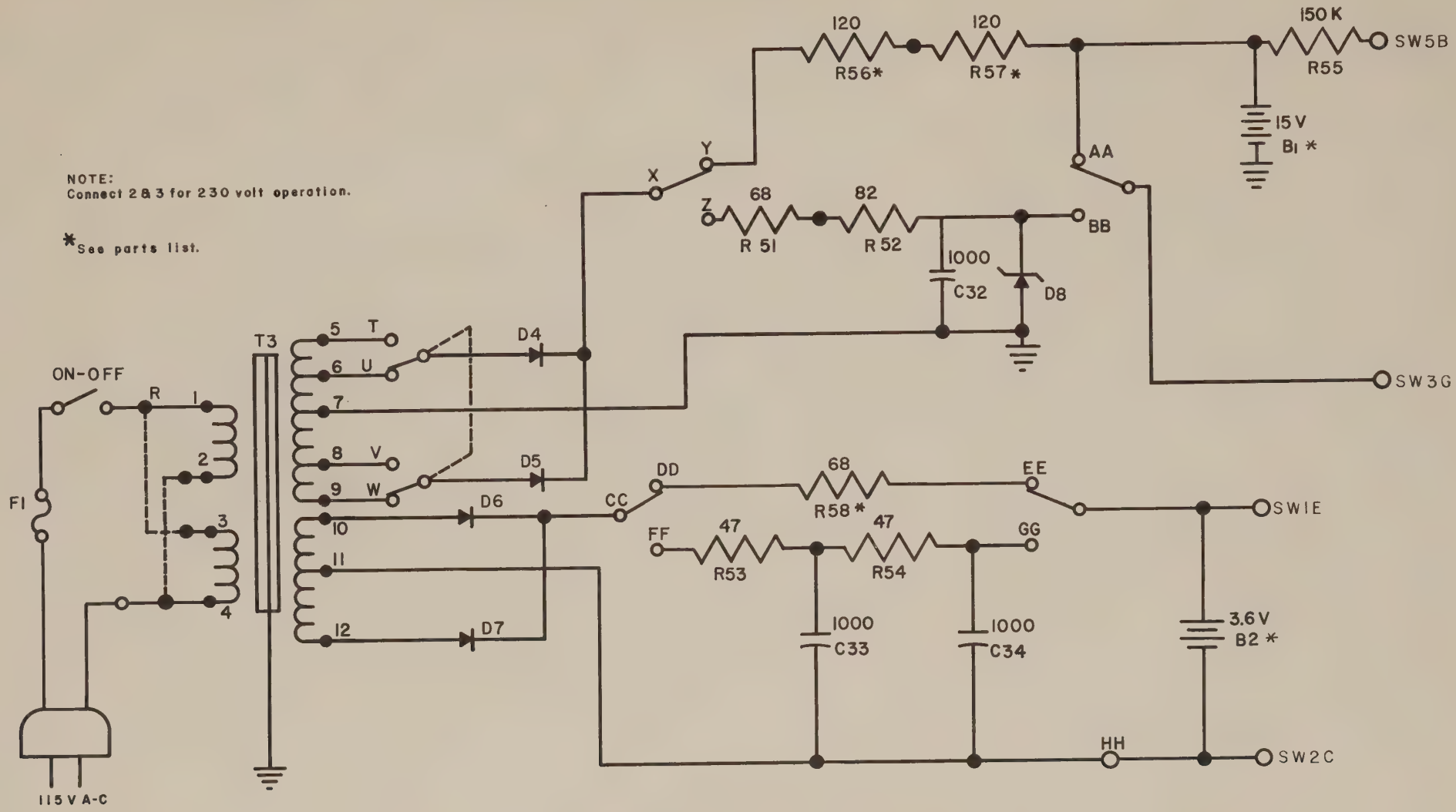
Table 5–1. Resistance Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	9.5 K	2.5 Meg	20 K	0	Fil	9.6 K	220	220	150 K
V2	12AV6	3.3 Meg	Inf.	Fil	0	150 K	150 K	350 K	—	—
V3	6EA8	8.0 K	150 K	250 K	Fil	0	11 K	2.2 K	1 K	34 K
V4	6EJ7	25 K	660 K	23 K	Fil	0	0	11 K	9.5 K	0
V5	6BZ6	1 Meg	1 K	Fil	0	350 K	125 K	1 K	—	—
V6	12BY7A	25 K	67 K	0	0	0	Fil	8.5 K	25 K	0
V7	12BA6	2.8 Meg	0	Fil	0	11 K	10K	100	—	—
V8	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V9	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V10	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V11	6BZ6	2.5 Meg	150	0	Fil	10 K	13 K	0	—	—
V12	12BA6	2.5 Meg	0	Fil	0	10 K	13 K	68	—	—
V13	12AX7	1 Meg	22 K	45 K	0	0	2.2 Meg	55 K	48 K	Fil
V14	13DE7	8 K	2.5 Meg	2.5 Meg	Fil	0	2.2 Meg	22 Meg	0	Inf.
V15	12BA6	2 Meg	0	0	Fil	10 K	13 K	25 K	—	—
V16	6GX6	2.2 Meg	1 K	0	Fil	250 K	9.2 K	22 K	—	—
V17	6AQ5	500 K	270	0	Fil	8.7 K	8 K	500 K	—	—
V18	12AX7	350 K	6.8 Meg	0	0	Fil	350 K	500 K	3.3 K	N. C.
V19	6EV7	13 K	4.5 Meg	0	Fil	0	110 K	450 K	820	1.5 Meg
V20	OA2	7.8 K	0	Inf.	0	7.8 K	Inf.	0	—	—

REF DES	Transistor Type	MEASURED AT:		
		Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	5.6 K	43 K
Q4	2N3394	0	750	1.1 K
Q5	2N3877	1 K	56 K	6.8 K

NOTE:

All measurements were made with respect to ground with the power supply disconnected from the TR 4C. The BAND switch was on 7.0 MHz, the Mode switch was on CAL and the RCVR GAIN and XMTR GAIN controls were fully clockwise. The VOX, ANTI VOX and SIDETONE controls were fully clockwise and the ZERO control was set at the balance point. The accessory 34-PNB



312A POWER SUPPLY FIGURE 19

Drake Home Page Drake Technical Tips Menu

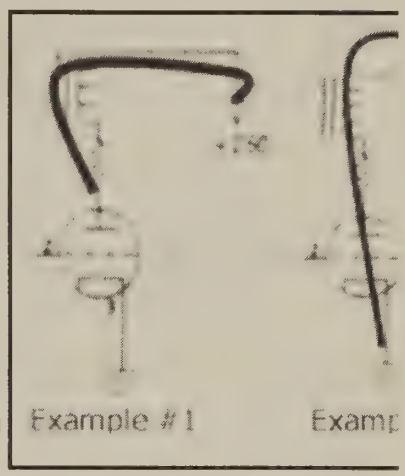
BIAS

TROUBLE SHOOTING ANTENNA RELAY PROBLEMS

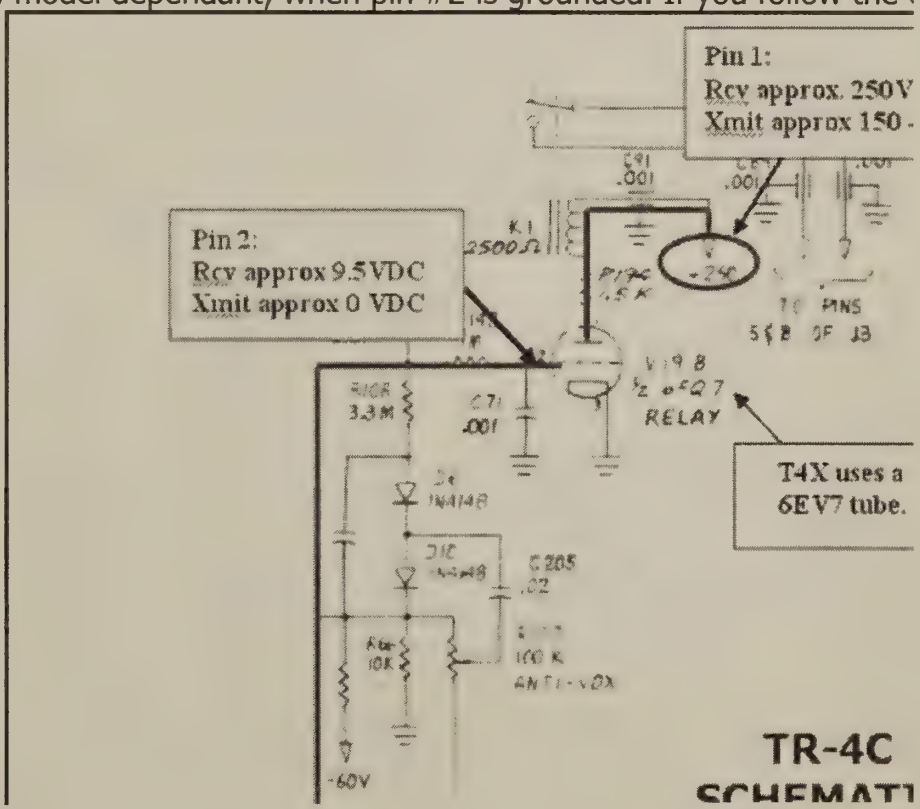
Written by: Mark Gilger, WB0IQK

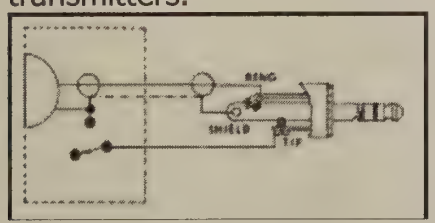
This write up will cover the basics of how the PTT circuit in the TR-3 through TR-4CW and T4X transmitters works. Non specific trouble shooting aids are supplied that pertain to any of these The PTT circuits in the different models are slightly different, but are functionally alike. This art teaches the basics and is not meant as a guide on specific fixes.

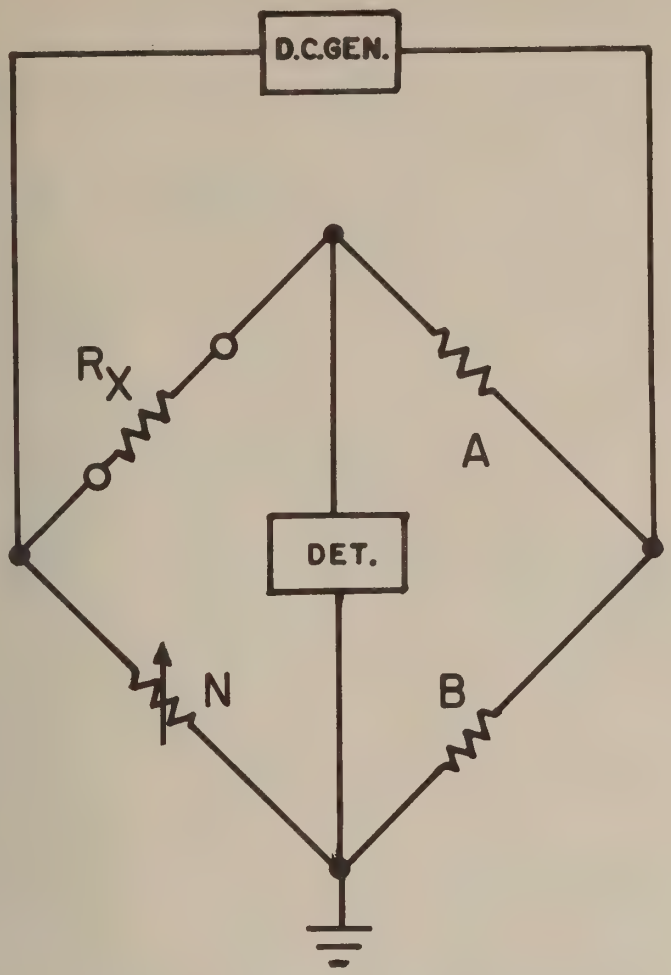
The Basics:



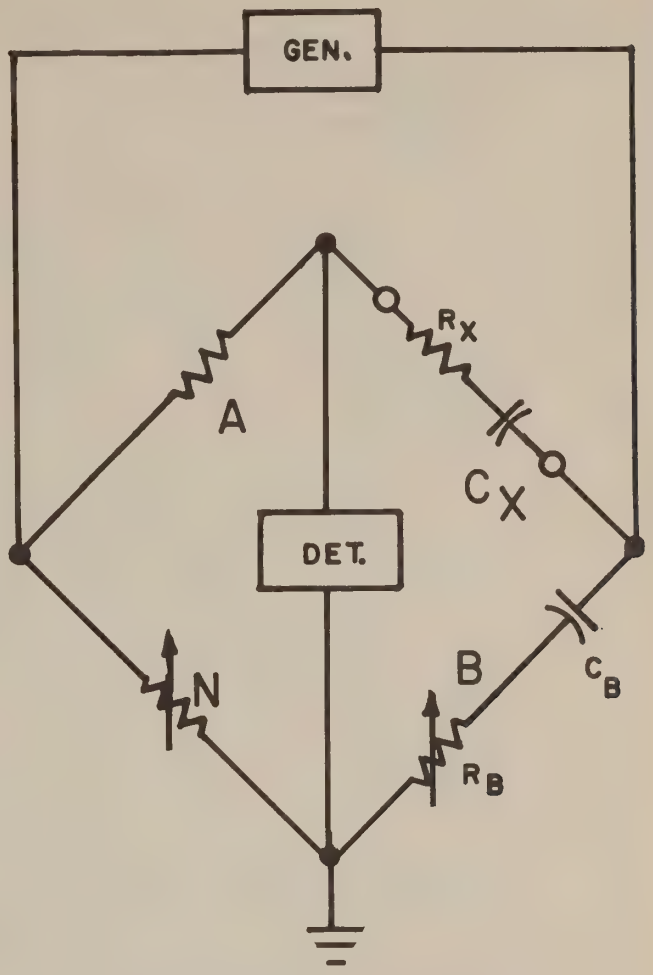
Before you can get any relay energized, you need a path for the current to flow through the relay coil. In this case it's designated as K1. In this first example, you have the correct voltage, +250VDC from the supply all the way to the plate of the tube. If the tube is cut off, there will be no current path to ground. There is usually a small negative voltage (-10 VDC) on the grid of the tube when in the receive mode. In this example it's pin #2. This cuts the tube off in the receive mode. If you ground pin#2, the tube will turn on and current now can flow. Once you have current flow, the relay will pull in. If you check the plate voltage, Pin #1 in this example, it will drop from it's normal +240 - 250 VDC to anywhere from 150 – 220 VDC, model dependant, when pin #2 is grounded. If you follow the c through to the mic connector, the grid will connect to the tip of the mic plug. When the PTT button is pressed, the tip is grounded and pin #2's negative voltage now will go to zero, which now lets the tube conduct and pull in the K1 relay. The function switch will also ground this connection when it's moved to the X-CW position on the TR-3 through TR-4C, or the Tune position on the T4X series of transmitters.



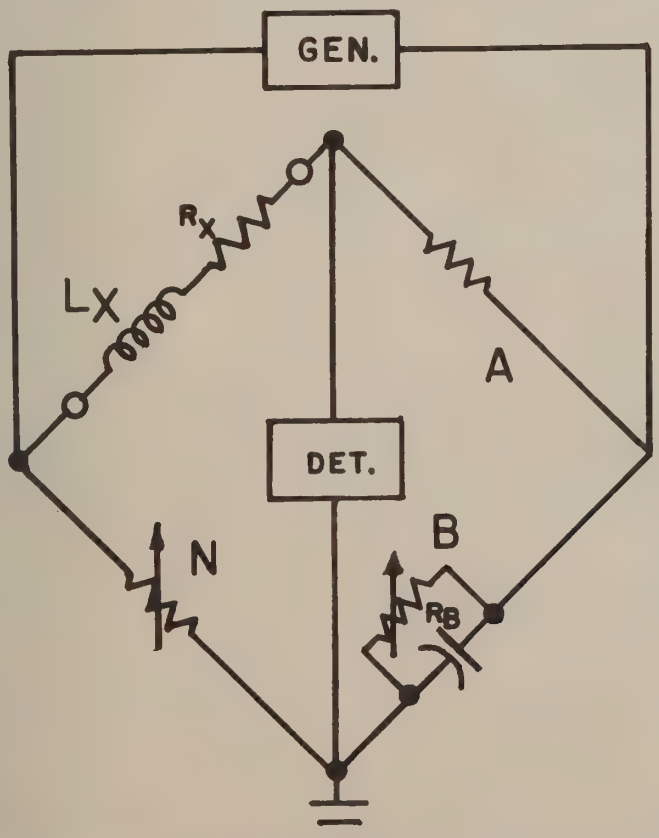




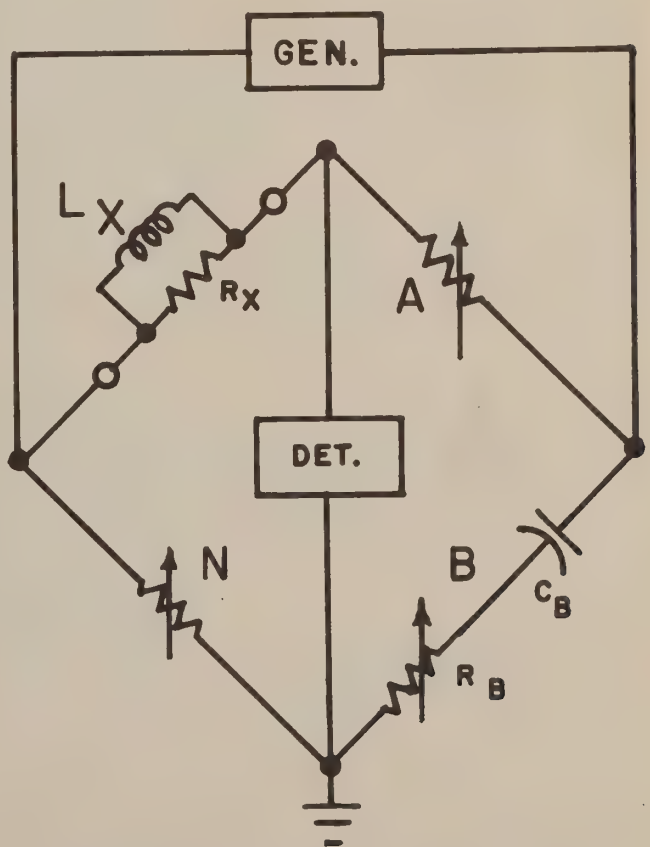
D.C. Resistance Figure 5



Capacitance Figure 6



Maxwell Inductance Figure 7



Hay Inductance Figure 8

Typical Problems:

1. The most likely problem is the Vox control tube (V19b in TR-3 to TR-4C models and V10b to T4XC models). The tube (6EV7 or 6FQ7) gets gassy or weak and either the relay will n energize, or its operation becomes very erratic. Replace the tube with a new one. Do not tube tester to tell you if it's good or bad. The best method is utilizing a NOS (New Old Sto from a reliable source.
2. The AC3 - AC4 power supply +250 volts supply could be bad. Make sure you have 240 – at the plate of the Vox tube. If no voltage is present, the diodes have probably gone out a need replaced. Also check the AC ripple. If excessive, the filter capacitors in the AC3 – A replaced.
3. The AC3 – AC4 bias supply could be bad. The voltage should be around -40 to –60 VDC. make adjustment to the bias adjustment control located on the supply per the instruction manual. If no voltage is present, the diodes have probably gone out and will need replace check the AC ripple. If excessive, the filter capacitors in the AC3 – AC4 need replaced.
4. The Anti Vox potentiometer is not adjusted correctly. If the Anti Vox is adjusted to sensiti not let the transmitter relay to turn on. The Anti Vox pot needs to be adjusted so that wh receiving a station, at comfortable listing levels, you can activate the relay. In the above you can see where the Anti Vox signal ties into the same point as the PTT from the voltag generated in the audio amplifier. If it's adjusted to sensitive, you will notice when you tur volume all the way down, the relay works.
5. The circuit path between the mic plug tip and the grid of the Vox tube is not good. You ca ohm meter and verify there is very low resistance (<1 ohm) between the mic plug and th input resistor, R142 in the TR4C. Your resistance should change as press the PTT button.
6. You can take a jumper wire and with one end grounded put the other end on the grid inp R142 in the TR4C. With a good 250 VDC on the plate, the relay should pull in. If the relay in, but does not when using the Mic, the problem is in the PTT line of the microphone.
7. If the relay seems to be activating ok, but intermittent results are obtained, cleaning coul order. See the separate write up on "Relay Care" which covers cleaning on the relay cont
8. If the relay hangs up, even after the tube has been removed for trouble shooting, the foll possible fixes were suggested have been made others.

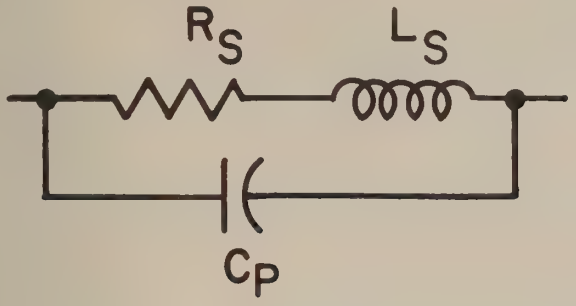
    - Check the wiring from the relay to the tube plate circuit, looking for any insulat problems. This could cause shorting to ground and thus causing current flov the relay, pulling in the relay.

    - If you can tap the relay and the contacts release, suspect possible mechanical l contact magnetization. Please note that mechanical problems are rare.

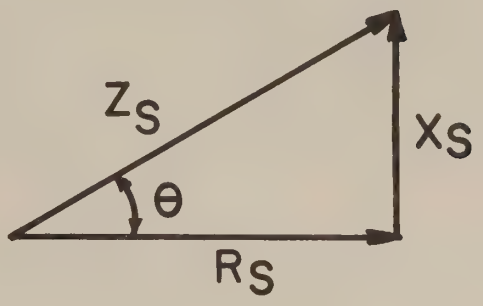
    - On rare occasion, relay contacts have been known to get magnetized. When th you will need to replace the relay or try and demagnetize it, possibly with a degaussing tool. It's unknown if the degaussing tool will work.

    - Check for carbon tracks on the tube and relay socket. Clean with Denatured Alc tooth brush. The socket might need to be replaced.

A.

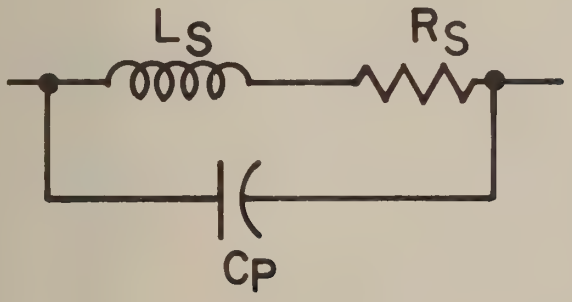


B.

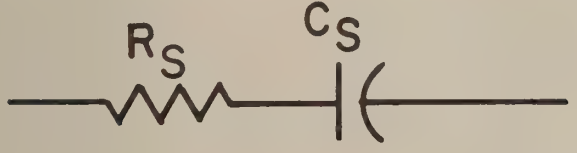


$$Q = \tan\theta = \frac{X_S}{R_S} = \frac{\omega L_S}{R_S} = \frac{1}{D}$$

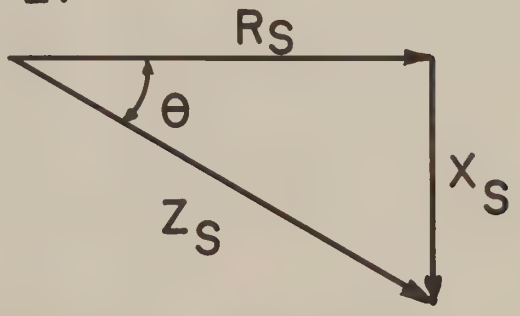
C.



D.



E.

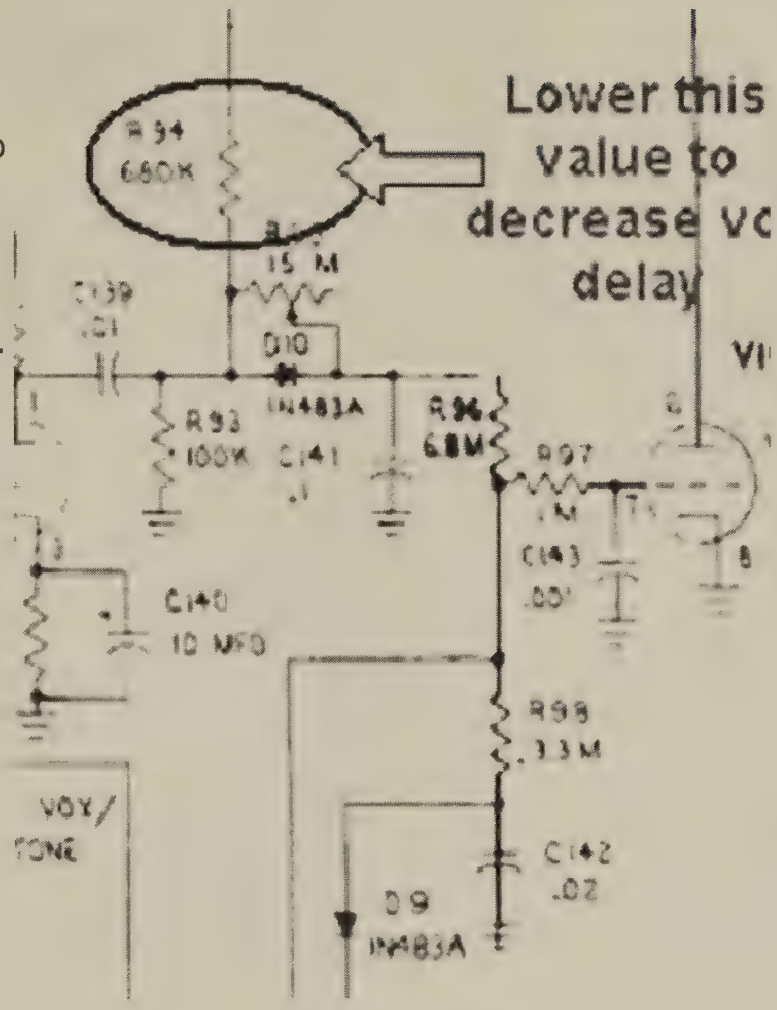


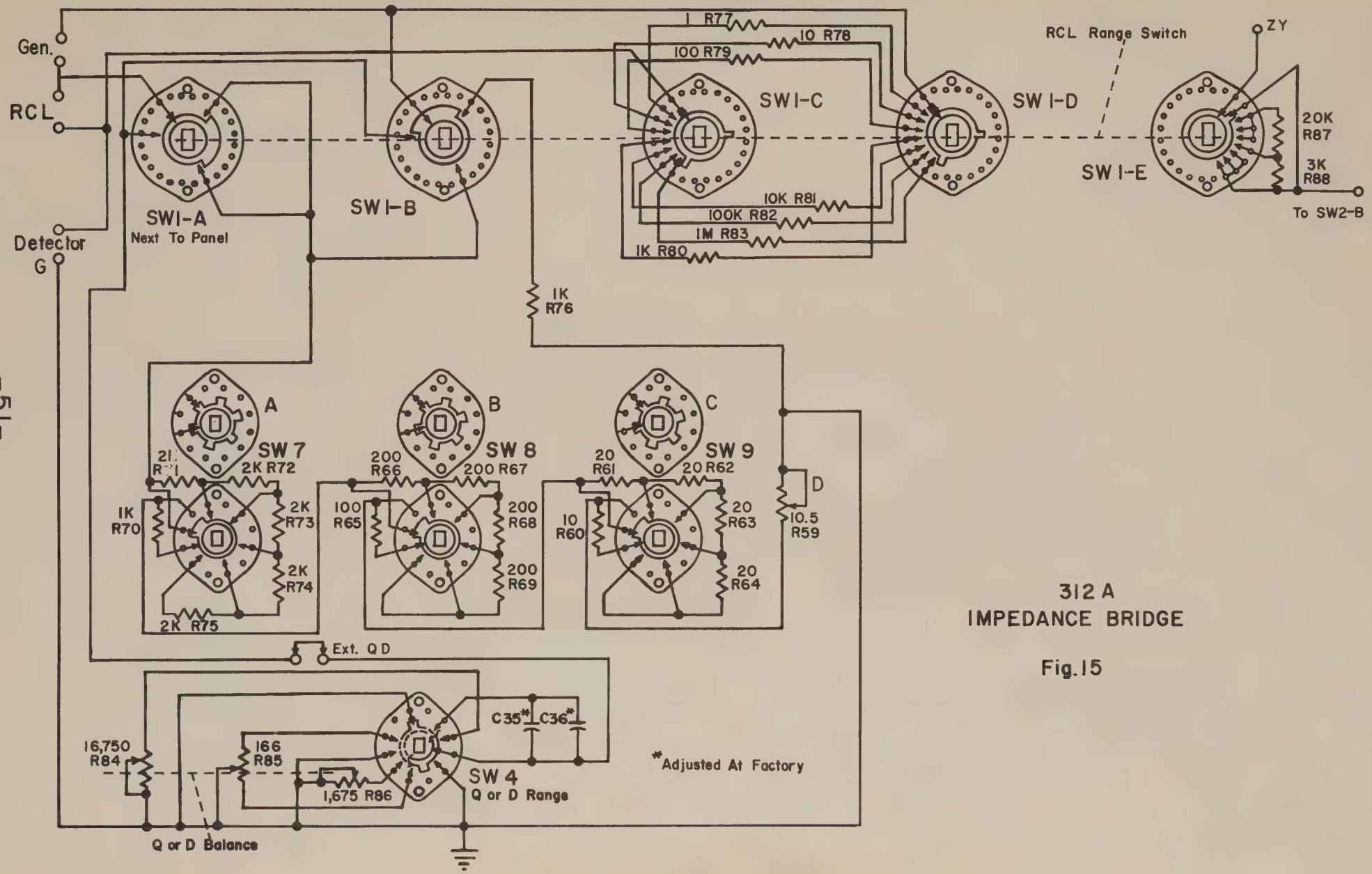
$$D = \cot\theta = \frac{R_S}{X_S} = \omega R_S C_S = \frac{1}{Q}$$

Residual Impedances Figure 13

T-4XB Relay Hanging

My T-4XB developed a problem where the relay would not deactivate for 1 - 2 second when going from transmit back to receive. I check all the components, thinking some had drifted out of tolerance. I did find several, which I replaced. The problem still persisted. I then experimented with the value of R94. I found that if I lowered this value, the delay went away. I replaced it with a smaller value, and it's been working fine every since.





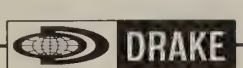
312 A
IMPEDANCE BRIDGE

Fig. 15

DRAKE AMATEUR PRODUCTS

R-4C	*Receiver, covers the 160 meter through 10 meter amateur bands and up to fifteen additional 500 kHz ranges. It has 8-pole crystal filter selectivity with passband tuning and transceives with the T-4XC with excellent sensitivity.*
T-4XC	*Transmitter, covers the 160 through 10 meter amateur bands and most other frequencies between 1.5 and 30 MHz. It has 8-pole crystal filters for sideband selection. It may be used to transceive with the R-4C.*
TR-4C	*Transceiver, 300 Watt high frequency single-sideband unit covers the 80 meter through 10 meter amateur bands. Includes AM and CW modes, a linear, permeability-tuned VFO and two 8-pole crystal lattice filters.*
L-4B	*Linear Amplifier, built for continuous duty at full capacity. 2000 Watts PEP on SSB. 1000 Watts on AM, CW and RTTY. Covers the 80 meter through 10 meter bands.*
C-4	*Station Console, matches Drake's T-4XC, R-4C and TR-4C.*
MN-4	*Antenna Matching Network, matches 50 Ohm transmitter output to coax antenna feedline with VSWR up to 5:1. An integral Wattmeter reads forward power in Watts and VSWR directly. 200 Watts continuous duty output.*
MN-2000	*Antenna Matching Network. Same as MN-4 except: 1000 Watts continuous duty output (2000 Watts PEP) and 3 antenna connectors switch-selectable from front panel.*
W-4	*Wattmeter, reads forward and reflected power directly in Watts (VSWR from nomograph). Range: 200 and 2000 Watts full scale, 1.8 to 54 MHz.*
WV-4	*Wattmeter, reads forward and reflected power directly in Watts (VSWR from nomograph). Range: 100 and 1000 Watts full scale, 20 to 200 MHz.*
TR-22C	*Transceiver, 2 meter VHF-FM, portable. Twelve channels, self-contained batteries and attached microphone.*
RCS-4	*Remote Coax Switch, provides remote selection of up to five antennas, using only one main feedline. Allows grounding of unused antennas. Motor driven switches controlled from station located console.*
SSR-1	*General Coverage Receiver, 0.5-30 MHz continuous. All solid state.*

For information on any of our products, please feel free to write our Sales Department, 540 Richard Street, Miamisburg, Ohio 45342 or call direct, 513-866-2421.




DRAKE

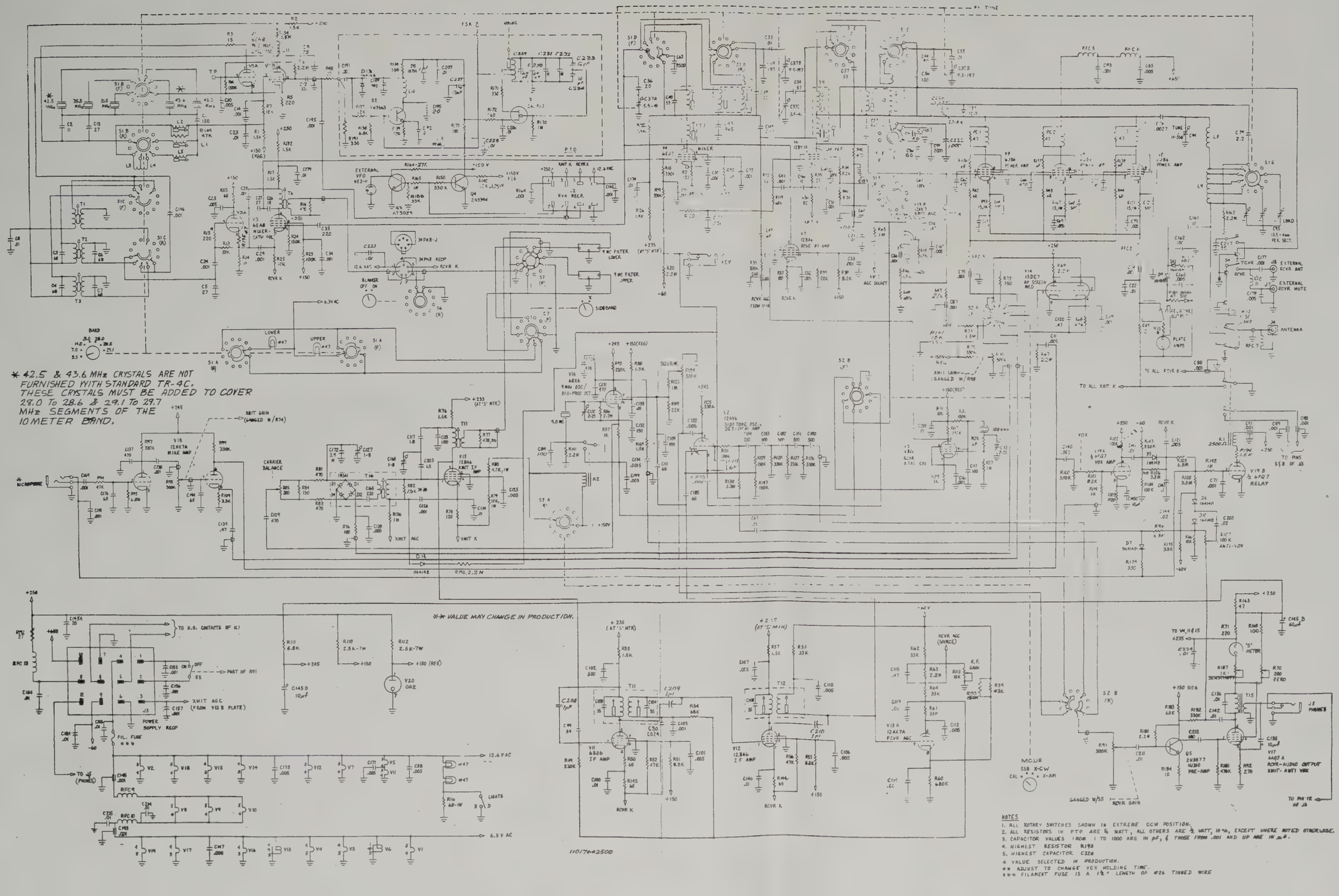


Figure 5–5. TR–4C Schematic

BAND, FUNCTION, and BLANKER switches viewed in counter clockwise position.
All resistors in VFO assembly T-5 are 1/4 watt.
All other resistors are 1/2 watt 10%, except where noted.
Capacitor values from 1 to 1000 are in pF and those from .001 are in mfd unless otherwise noted.

I_2 and I_3 shown outside view.

Highest resistor R186
Highest capacitor C214

* Value selected in production.
** Adjust to change VOX holding time.
*** Filament fuse is a 1-1/2" length of #26 tinned copper wire.

SCHEMATIC DIAGRAM
MODEL TR-4 TRANSCEIVER

811-1030500

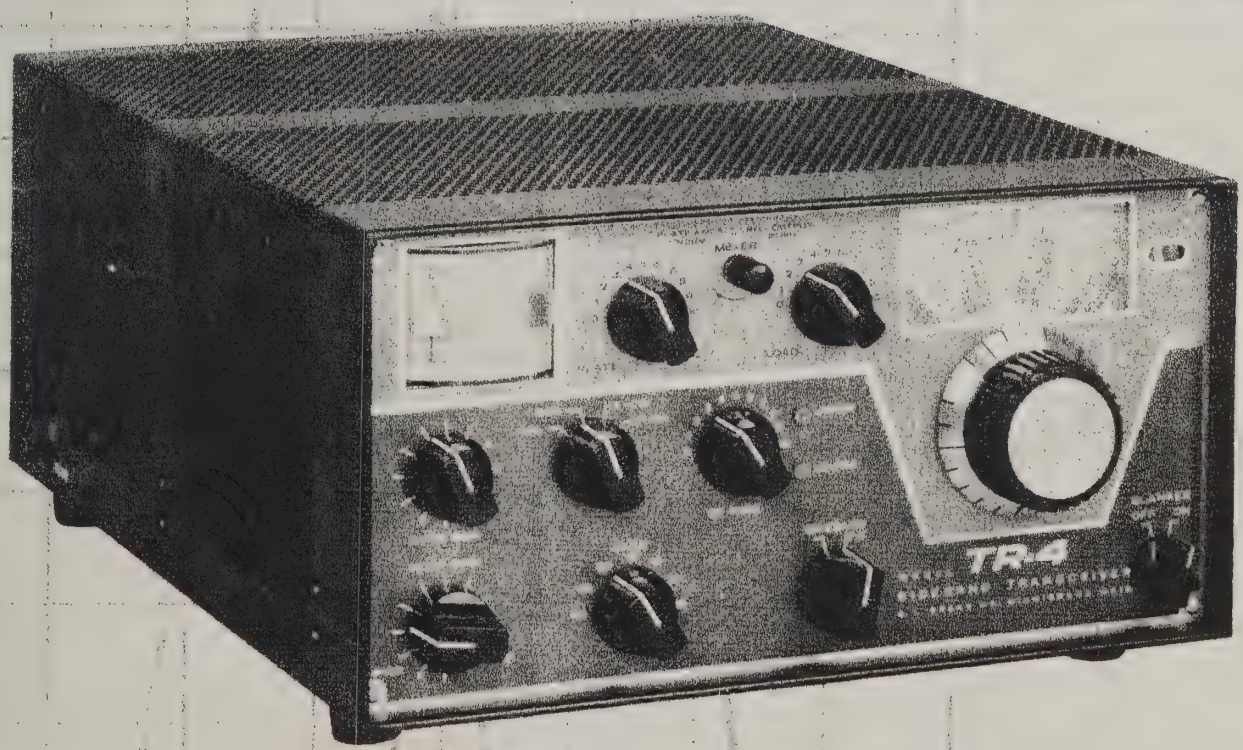
FIGURE 21

INSTRUCTION MANUAL

R. L. DRAKE • MODEL

TR-4

SIDEBAND TRANSCEIVER



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CHARTS AND ILLUSTRATIONS

FIGURE		PAGE
1	Front View	7
2	Connecting TR-4 to AC-4	11
3	Connecting TR-4 to Linear Amplifier	12
3.1	Connecting TR-4, T-4X to Linear Amplifier	12
4	Using TR-4 with External Receiver	13
5	Electrical Connections for Mobile Installation of TR-4	13
6	Mechanical Details of Mobile Installation	14
7	Viewing Angle Options	15
8	Rear View	20
9	Side View	23
10	Attenuators for Using TR-4 with Linear Amplifier	27
11	Typical Selectivity Curve - Crystal Filters	32
11A	Block Diagram	32
12	Resistance Chart	35
13	Voltage Chart	36
14	Top View	38
15	Bottom View	39
16	Schematic Diagram - AC-4 Power Supply	45
17	Schematic Diagram - DC-4 Power Supply	47
18	Schematic Diagram - RV-4 Remote VFO	52
19	FF-1 Mounted Under TR-4	53
20	FF-1 Fixed Frequency Adapter Schematic	54
21	TR-4 Schematic (fold out page)	55
22	Noise Blanker Block Diagram	57
23	Circuit Board Layout, 34-PNB	60
24	34-PNB Noise Blanker Schematic (fold out page)	60

TABLE OF CONTENTS

GENERAL SPECIFICATIONS 1
TRANSMITTER SPECIFICATIONS 4
RECEIVER SPECIFICATIONS 5
TUBE/TRANSISTOR FUNCTION 6

I. GENERAL DESCRIPTION 7

II. INSTALLATION INSTRUCTIONS 8
- A. Unpacking 8
- B. Antenna 8
- C. Speaker 8
- D. Microphone 8
- E. Location 9
- F. Fixed Installation 9
- G. Mobile Installation 10

III. CONTROL FUNCTIONS 16
- A. Front Panel Controls 16
- B. Side Controls & Jacks 18
- C. Rear Controls & Jacks 19
- D. Other 19

IV. TUNING PROCEDURE 21
- A. Bias Adjustment 21
- B. Adjusting Dial Calibration 21
- C. Tune-Up on Desired Band 21
- D. Adjust.of Carrier Balance Control 23

V. OPERATION 24
- A. VOX on SSB 24
- B. PTT on SSB 24
- C. CW Operation 25
- D. AM Operation 25
- E. General Precautions for Operation Near Band Edge 26
- F. Operation with Linears 26

VI. THEORY OF OPERATION 28
- A. Receiver Circuitry 28
- B. Transmitter Circuitry 30

VII. SERVICE DATA 33
- A. Removing Top Cover 33
- B. Removing Bottom Cover 33
- C. Tube Replacement 33
- D. Trouble Shooting 33

VIII. ALIGNMENT INSTRUCTIONS 4
- A. Xtal Calibrator Alignment 4
- B. 9.0 MHz Oscillator Adjust. 4
- C. Xtal Oscillator Alignment 4
- D. VFO Adjustment 4
- E. Adjustment of Injection Coupler 4
- F. Receiving IF Alignment 4
- G. Adjustment of Balanced Mod. 4
- H. Filter Matching Transformers 4
- I. Carrier Balance Adjustments 4
- J. Adjustment of Mixer/RF Coils 4
- K. Final Amplifier Neutralizing 4
- L. Transmitting IF Neutralizing 4

IX. AC-4 POWER SUPPLY 4

X. DC-4 POWER SUPPLY 4
- A. General Description 4
- B. Specifications 4
- C. Installation 4

XI. RV-4 REMOTE VFO 4
- A. Removal from Cabinet 4
- B. Tube Replacement 4
- C. Troubleshooting 4
- D. Alignment 5

XII. FF-1 FIXED FREQUENCY ADAPTER 5
- A. Description 5
- B. Operation 5

XIII. 34-PNB PLUG IN NOISE BLANKER 5
- A. General Description 5
- B. Operation 5
- C. Installation 5
- D. Description 5
- E. Alignment 5

GENERAL SPECIFICATIONS

FREQUENCY COVERAGE
Full coverage on all amateur bands 10 through 80 meters, in seven 600 kHz ranges: 3.5 to 4.1 MHz, 7.0 to 7.6 MHz, 13.9 to 14.5 MHz, 21.0 to 21.6 MHz, 28.0 to 28.6 MHz, 28.5 to 29.1 MHz, 29.1 to 29.7 MHz.

SOLID STATE VFO
Has linear permeability tuning. Tunes 4.9 to 5.5 MHz for all ranges.

DIAL CALIBRATION
10 kHz divisions on Main Tuning dial and 1 kHz on tuning knob skirt. Effective length of circular dial scale is over 14 inches.

FREQUENCY STABILITY
High stability solid state VFO tunes same range on all bands. Overall drift is less than 100 Hz after warm-up, and less than 100 Hz for ± 10% line voltage change.

MODES OF OPERATION SSB (Upper or Lower Sideband), CW, and AM.

FRONT PANEL CONTROLS

MAIN TUNING
Fluted knob with adjustable 25 division skirt. Tunes VFO and rotates main dial.

RF TUNE
Tunes the RF circuits common to receiver RF amplifier and transmitter driver stages. 0 - 10 scale.

PLATE AND LOAD
These tuning controls adjust pi-network capacitors in transmitter for proper resonance and loading on each band.

BAND
This switch selects desired ham band (see "Frequency Coverage" above).

FUNCTION
This switch has four positions; CAL, SSB, X-CW, X-AM.

1. CAL operates built-in 100 kHz crystal calibrator for accurate setting of Main Tuning hair line indicator and knob skirt.
2. SSB provides SSB operation, either VOX or PTT.
3. X-CW provides for CW operation with automatic transmit receive switching and CW sidetone, and is used for tune up.
4. X-AM provides controlled carrier AM operation with VOX or PTT, and with diode detector for receiving.

FRONT PANEL CONTROLS (Continued)

XMTR GAIN
Functions as mike audio gain on SSB and AM, and as carrier injection control on CW.

RCVR GAIN
Knob controls receiver AF Gain and Power ON-OFF switch. Lever behind knob. controls setting of RF Gain.

SIDEBAND
Switch in conjunction with indicator lights marked "Upper" and "Lower", selects desired sideband by connecting into the circut either the upper or lower sideband filter. ("X" position used when in "X-CW" or "X-AM" positions of Function Switch.)

OUTPUT METER CONTROL
This switch converts plate meter to read relative output, when pushed. Rotating varies output meter sensitivity.

RIGHT SIDE SCREWDRIVER ADJUST CONTROLS
Vox Gain, Anti Vox Gain, S-Meter Zero.

RIGHT SIDE JACKS
Headphone (disconnects speaker circuit), Microphone (3-circuit for PTT), Key (normally closed).

REAR CONTROLS
Sidetone (adjusts sidetone volume), Lights (for dimming dial lights).

REAR JACKS
POWER (connects TR-4 to power supply and speaker),
RCVR MUTE (for muting an external receiver),
RCVR ANT (Uses TR-4 antenna relay to connect an external receiver to antenna),
ANTENNA (for connecting the TR-4 to the antenna).

LEFT SIDE CONTROLS
TCVR/RCVR switch (for selecting between the use of the TR-4 or an external receiver for receiving).

INSIDE CONTROLS
Carrier Balance

FRONT PANEL CONTROLS (Continued)

METERS

Receiver - S-Meter/Transmitting AGC Indicator, and
Transmitter - Plate Ammeter/Relative RF Output Indicator.

MISCELLANEOUS

Twenty tubes including voltage regulator; five transistors, ten diodes; one 100 kHz crystal calibrator built-in.

DIMENSIONS

5-1/2" High
10-3/4" Wide
14-3/8" Deep

WEIGHT

16 pounds

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TRANSMITTER SPECIFICATIONS

SINGLE SIDEBAND

300 Watts PEP input power, VOX or PTT. Two special 9 MHz crystal filters provide upper or lower sideband selection on any band, without the necessity of shifting oscillators. Unwanted sideband suppression of more than 60 dB and carrier suppression of 50 dB. Overall audio frequency response 400 to 2500 Hz at 6 dB down. Distortion products 30 dB down at maximum output.

CW

Power input 260 Watts. Carrier is shifted approximately 1000 Hz into one sideband, and mixer and driver are keyed. Grid block keying is free from chirps and is properly shaped to minimize clicks. Automatic transmit/receive switching when key is operated. CW sidetone oscillator for monitoring.

AM

Controlled carrier AM screen modulator is built-in. 260 Watts PEP input. Low carrier power increases 6 times to 50 watts output at maximum modulation. This system is compatible with SSB linears. VOX or PTT. Diode detector used for receiving on this mode. Product Detector can be used by switching manually.

OUTPUT IMPEDANCE

Nominal 50 ohms, adjustable with pi-network.

MICROPHONE INPUT

High-impedance.

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RECEIVER SPECIFICATIONS

SENSITIVITY
Less than 1/2 Microvolt for 10 dB S+N/N.

AGC
Full AGC on received modes. Audio output varies less than 3 dB for 60 dB change in signal level. Any amount of AGC from zero to full can be obtained by adjustment of RF Gain control. Time proven Drake AGC system provides fast attack and slow release with noise pulse suppression. No pumping or popping evident.

ANTENNA INPUT
Nominal 50 Ohms.

AUDIO RESPONSE
400 to 2500 Hz at 6 dB.

AUDIO OUTPUT POWER
2 Watts.

AUDIO OUTPUT IMPEDANCE
4 Ohms.

POWER SUPPLY REQUIREMENTS
Due to the 300 Watt PEP input rating, the TR-4 will require a power supply capable of low voltage at high current with very good dynamic regulation. The voltage and current requirements are as follows:

1. 650 Volts at 300 mA average and 500 mA maximum with 10% regulation from 100 mA to 500 mA and maximum ripple of less than 1%.
2. 250 Volts at 175 mA with 10% regulation from 150 mA to 180 mA. This includes the effect of the 650 Volt supply change if both voltages are obtained from the same transformer. Maximum ripple must be less than 1/4%.
3. -45 to -65 VDC adjustable filtered bias into 33 K Ohm load.
4. 12.6 Volt AC or DC at 5.5 Amps.

x

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TUBE AND TRANSISTOR COMPLEMENT	FUNCTION	
	TRANSMITTER	RECEIVER
12AX7	Mike Amplifier	----
6EV7	Vox Amp/Relay	----
6GX6	9 MHz Xtal Osc.	BFO/Prod.Det.
12BA6	IF Amplifier	----
12BA6	----	IF Amplifier
6BZ6	----	IF Amplifier
12AX7	AGC	AGC
6AQ5A	Anti-Vox	Audio Output
6EJ7	Mixer	----
6EA8	Cathode Fol.	Mixer/Cath.Fol.
6EA8	Pre-Mixer/Xtal Osc.	Pre-Mixer/Xtal Osc.
12AV6	Sidetone Osc.	Diode Det/1st AF Amp
13DE7	AM Screen Mod.	----
12BA6	----	RF Amp.
6BA6	----	Crystal Calib.
12BY7	Driver	----
(3) 6JB6 Matched	Power Amps.	----
OA2	Voltage Reg.	Voltage Reg.
2N5950	VFO	VFO
2N3563	VFO Buffer	VFO Buffer
2N3394	VFO Shut Off	VFO Shut Off
AT5059	Neon Driver	Neon Driver
2N3877	----	Audio Pre-Amp

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I. GENERAL DESCRIPTION

The R. L. Drake Company model TR-4 is a single sideband transceiver designed for the transmission and reception of upper and lower sideband signals on the 80 through 10 meter amateur bands. AM and CW capabilities are included.

Its compact size makes it ideal for both fixed station use in conjunction with our model AC-4 120/240 Volt, 50/60 Hz, AC power supply, or for mobile installations using our model DC-4 or DC-24,12 Volt DC power supply.

The 300 Watt PEP input on SSB enables the TR-4 to give an excellent account of itself "barefoot" and it will drive the highest powered ham linear amplifiers.

Upper and lower sideband selection is accomplished by switching between two 9 MHz crystal lattice filters with 2.1 kHz passbands. Among the other features included on the TR-4 are VOX and PTT on SSB and AM, diode detection for AM, shifted carrier CW, automatic transmit/receive switching on CW, built in CW sidetone, separate RF and AF gain controls, solid state VFO with linear permeability tuning, transmitting and receiving AGC indicator and plate ammeter/RF output indicator, adjustable pi-network output, and built in crystal calibrator.

The addition of the accessory RV-4 remote VFO speaker combination enables the operator to receive, transmit, or transceive throughout the band being used without disturbing the setting of the TR-4 tuning dial. This is useful for working DX stations operating outside the United States phone bands, or for working near your own frequency in search of a clear spot under crowded band conditions.

The accessory FF-1 is a fixed frequency adapter useful wherever crystal controlled operation is desired. It provides two switch selected channels and allows "off", crystal controlled "transmit" only or "transceive" operation.

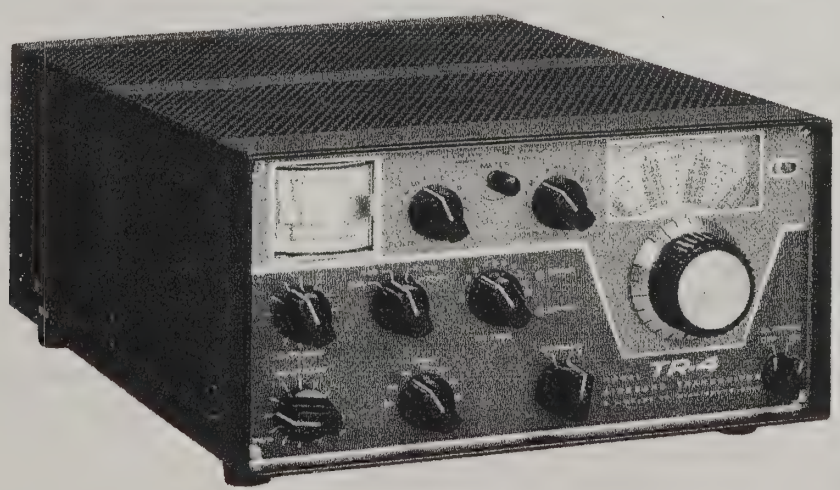


FIGURE 1. FRONT VIEW OF TR-4 TRANSCEIVER

III. CONTROL FUNCTIONS

A. FRONT PANEL CONTROLS

1. MAIN TUNING - The Main Tuning knob of the TR-4 determines the frequency on which you transmit and receive. Each division around the calibrated skirt on this knob is equal to 1 kHz and each division on the Main Tuning dial is equal to 10 kHz. The small red knob just to the right of the dial scale is for adjusting the position of the indicator line for calibration. The knob skirt is also adjustable by pushing it in slightly and rotating it in the desired direction, while holding the Main Tuning knob stationary.

2. SIDEBAND - The SIDEBAND control selects either of two 2.1 kHz crystal filters for transmission and reception of upper and lower sidebands. Directly above this control are two indicator lights which show the sideband in use for a particular band. You will notice that one position of this switch is marked with an "X". This position must be used when operating AM or CW or when tuning up.

3. BAND - The BAND control is a seven position switch used to select the amateur band desired. You will notice that it has three 10 meter positions. Proceeding in a clockwise direction, the first covers 28.0 - 28.6 MHz, the second covers 28.5 - 29.1 MHz and the third covers 29.1 - 29.7 MHz.

4. RCVR GAIN - The RECEIVER GAIN control consists of two controls with concentric shafts. The lever controls the maximum RF gain of the receiver by varying the amount of negative bias applied to the grids of the AGC controlled tubes.

   The knob adjusts the audio gain by regulating the input to the grid of the audio power amplifier tube. The transceiver power switch is operated at the extreme counter clockwise end of rotation of this knob.

5. XMTR GAIN - The TRANSMITTER GAIN control regulates the microphone gain on AM and SSB. When the unit is operated on CW, it is used to adjust the RF drive to the proper level.

   This control is connected so that it regulates the VOX sensitivity as well as the audio drive to the balanced modulator. Since all changes in level due to the type microphone, how close or loud you talk, etc. effect equally the VOX and audio drive requirements, this eliminates the necessity of changing the VOX adjust control, located on the side of the TR-4 chassis, once it is set properly.

6. FUNCTION - The FUNCTION control is a four position switch which determines the mode of operation of the TR-4.

In the SSB position, the receiver portion functions until the transmitter is energized either by talking into the microphone or pressing the Push-To-Talk switch. The transmitter then emits an upper or lower sideband signal depending on the setting of the SIDEBAND switch.

In the CAL position, the 100 kHz crystal calibrator is switched on for calibration purposes. The receive and transmit functions operate the same as in the SSB position.

In the X-CW position, the receiver portion functions until a key plugged into the key jack, is closed. It then goes into the transmit mode, a CW sidetone is energized, and the carrier is shifted approximately 1 kHz from the received frequency. It will remain on transmit during CW keying and will return to receive when keying is stopped briefly. Note that the SIDEBAND switch must be on the "X" position when operating X-CW or X-AM. Otherwise, no RF output will be obtained.

It should also be noted that if the relays occasionally fail to close when the Function switch is placed in the X-CW position and the key, if used, is closed, the VOX GAIN control should be advanced until positive relay action is obtained.

The X-CW position is also used for tuning up the transmitter. The key jack is a closed circuit type so it is not necessary to plug in a key for tune up.

On the X-AM position, a controlled carrier screen modulator is incorporated for AM transmission, and a diode detector is incorporated for AM reception. Transmit receive switching is accomplished by VOX or PTT as on SSB.

7. RF TUNE - The RF TUNE control peaks the driver and RF amplifier grid and plate coils.

8. PLATE - The PLATE control tunes the power amplifier pi-network circuit to resonance by varying the input capacity.

9. LOAD - The LOAD control matches the impedance of the transceiver power amplifier to the impedance of the load by varying the output capacity of the pi-network circuit.

10. S-METER - The S-METER indicates relative signal strength of the received signal. It is calibrated in S-units from S-1 to S-9 and in dB over S-9. Each S-unit equals approximately 5 dB and S-9 equals about 30 Microvolts.

10. S-METER - (Continued) - On transmit, it indicates the point at which the transmitting AGC starts to help in setting the proper level of the XMTR GAIN control.

11. PLATE AMPERES - The PLATE AMPERES meter indicates plate current in the final amplifier tubes, and relative RF output.

12. OUTPUT METER CONTROL - This control consists of a push switch and potentiometer. Pushing in converts meter from Plate Amperes to a Relative Output indicator and rotating varies the sensitivity of this indicator.

13. BLANKER - The BLANKER control is a two position switch which turns on the Accessory, 34-PNB Noise Blanker. Low level signals, masked by noise impulses without the noise blanker, can be copied when the blanker is turned on.

    In most situations, it is desirable to leave the blanker on continuously. However, it may happen you are copying an extremely weak signal under no noise conditions. In this case, it may be advantageous to turn the blanker off since occasional peaks of atmospheric noise may trigger the blanker and generate additional noise.

B. SIDE CONTROLS AND JACKS (Front to rear)

1. PHONES - The headphone jack automatically disconnects the speaker when headphones are plugged in. The audio output impedance at the jack is 4 Ohms.

   (We recommend headphones having an impedance of approximately 500 Ohms.) (A speaker may be plugged in here instead of connecting it to the power connector if desired.) A Switchcraft Type 229 plug (red) is supplied with the TR-4 which can be used either here or at the KEY jack.

2. MIC - This is a .210 inch diameter phone jack of the three conductor variety to accommodate microphones with push-to-talk switches. It requires a Switchcraft Type S-230 plug which is supplied with your TR-4.

3. VOX - The VOX control adjusts the gain of the VOX amplifier and relay release time on CW.

4. ANTI-VOX - The ANTI-VOX control adjusts the sensitivity of the ANTI VOX amplifier.

5. ZERO - The S-Meter ZERO control is for adjusting the no signal reading of the S-Meter to S-1.

6. KEY - The KEY jack is of the normally closed variety. Note that plugging a key into this jack will disable the transmitter on all modes of operation and the receiver on AM unless the key is closed.

C. REAR CONTROLS & JACKS

1. LIGHTS - The LIGHTS control is a two position slide switch which is used to control the brilliance of the dial lights. The letters D and B indicate dim and bright respectively.

2. CARRIER BALANCE - The CARRIER BALANCE control is a potentiometer located on top of the chassis along the rear edge and is for balancing the balanced modulator. Note that this control has a planetary drive and requires 10-1/4 turns for complete travel.

3. SIDETONE - The SIDETONE control, located on the rear of the chassis, controls the volume of the CW sidetone with respect to the received signal. If no sidetone is desired, rotate the SIDETONE control fully counter clockwise.

4. RCVR MUTE - The RECEIVER MUTE jack provides a means of muting an external receiver without an external relay. It provides DC path to ground on receive and may be used with Drake 1-A, 2-A, 2-B, 2-C, R-4, R-4A, R-4B and SPR-4 Receivers.

5. RCVR ANT - The RECEIVER ANTENNA jack provides a means of connecting the antenna to an external receiver without an external relay.

6. ANTENNA - An SO-239 connector connects the TR-4 to the station antenna system.

D. OTHER

1. TCVR/RCVR - The TRANSCEIVER/RECEIVER switch selects between normal transceive and reception with an external receiver. It is located on the left side of the chassis.

2. PTO - (Permeability Tuned Oscillator) indicator lamp (mounted directly above the Main Tuning knob) and lights only while the TR-4 PTO is functioning. For example, when using an RV-4 with its Function switch in "RCV" and transmitting with the TR-4, the TR-4 indicator lamp lights. When the transmission has ended, the TR-4 lamp goes out. If the RV-4 used has an indicator lamp, it lights whenever the TR-4 lamp does not.

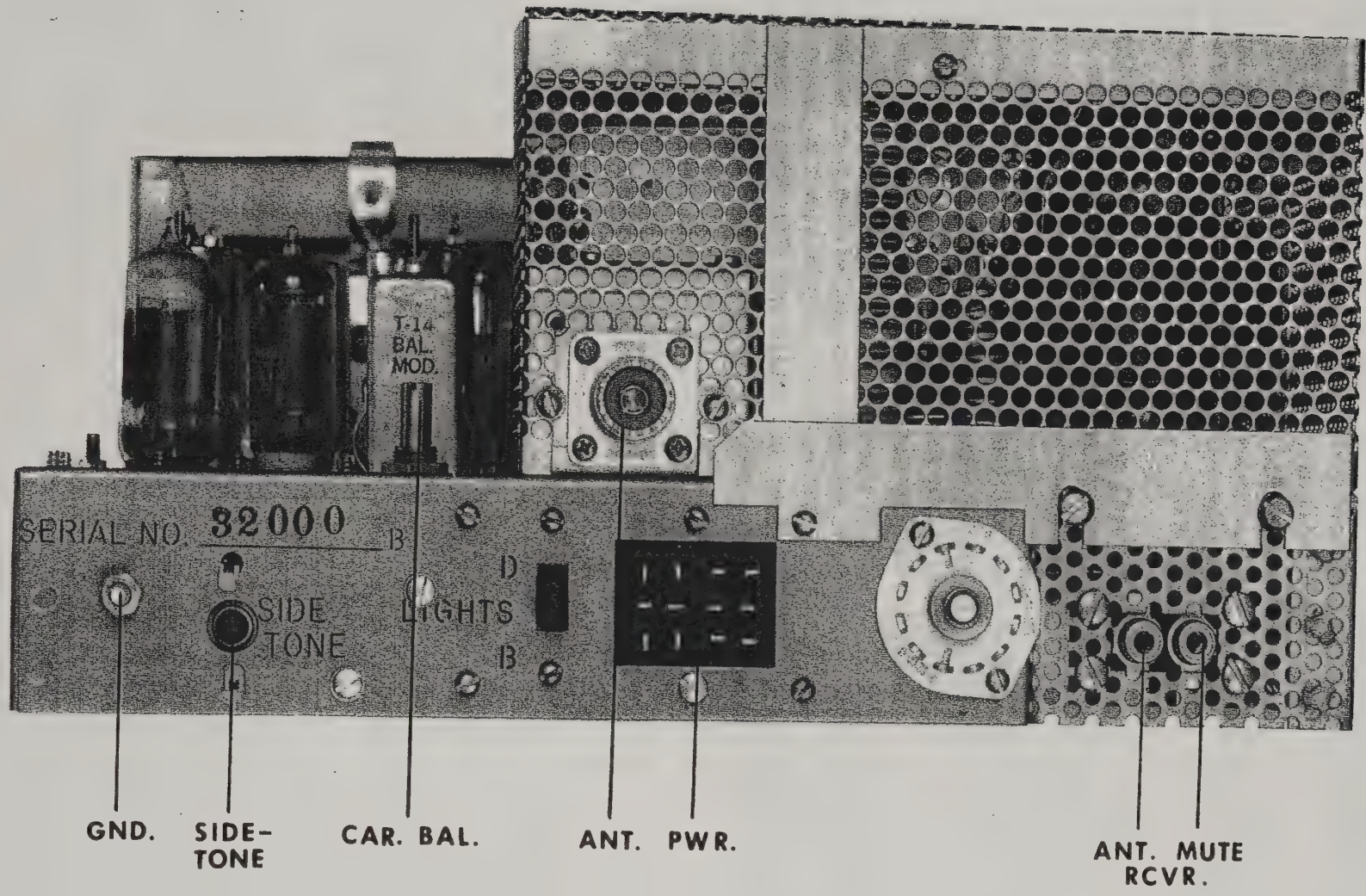


FIGURE 8. REAR VIEW OF TR-4 TRANSCEIVER

IV. TUNING PROCEDURE

WARNING: UNDER NO CIRCUMSTANCES SHOULD OPERATION OF THE TR-4 BE ATTEMPTED UNLESS IT IS CONNECTED TO A PROPER ANTENNA OR A DUMMY LOAD OF SUFFICIENT POWER HANDLING CAPACITY!

A. BIAS ADJUSTMENT

Before any type operation is attempted, it will be necessary to set the power supply bias adjustment as described here.

1. Turn on TR-4 by rotating RCVR GAIN control knob clockwise.
2. Rotate XMTR GAIN control fully counter clockwise.
3. Turn SIDEBAND switch to the counter clockwise position.
4. Turn FUNCTION switch to X-CW.
5. Adjust AC-4 or DC-4 BIAS adjustment for a reading of .1 on the Plate Amperes meter. This completes the adjustment.

B. ADJUSTING DIAL CALIBRATION

The calibration of the Main Tuning dial on the TR-4 may vary slightly from band to band due to the tolerance limits of the various crystals. Therefore, the Main Tuning dial index has been made adjustable by means of the small red knob to its right. To set the calibration on a given band, proceed as follows:

1. Set XMTR GAIN fully counter clockwise.
2. Set FUNCTION switch to CAL.
3. Set BAND SWITCH to desired band.
4. Peak RF TUNE for maximum noise.
5. Zero beat the 100 kHz calibrator signal nearest the desired operating frequency.
6. Slide the red knob to the right of the dial scale until the index line coincides with the 100 kHz dial calibration.
7. While holding the Main Tuning knob, push in on its calibrated skirt and rotate it until the arrow coincides with the indicator line.

C. TUNE-UP ON THE DESIRED BAND

WARNING: DO NOT ALLOW THE PLATE CURRENT TO EXCEED .1 AMPS FOR MORE THAN 5 OR 6 SECONDS IF THE PLATE CONTROL IS NOT TUNED FOR PLATE CURRENT DIP OR MAXIMUM RF OUTPUT. Failure to observe this warning will result in rapid final amplifier tube deterioration due to excessive plate dissipation.

NOTE: The final amplifier pi-network will match a 50 Ohm load with VSWR no higher than 2:1 except on 80 meters where a lower VSWR will be required. Here it may be found necessary to use an external "match box" or change the feed line by 1/8 to 1/4 wave length to get the proper match.

C. TUNE-UP ON THE DESIRED BAND (Continued)

Preset the controls as follows:

1. BAND SWITCH to desired band.
2. FREQUENCY knob to a frequency inside the amateur band in use.
3. XMTR GAIN fully counter clockwise.
4. LOAD fully counter clockwise.
5. SIDEBAND in the "X" position.
6. FUNCTION switch on SSB.
7. RF TUNE - temporarily peaked on received noise.

Rotate the FUNCTION switch to the X-CW position and advance the XMTR GAIN control clockwise until the Plate Amperes meter moves up scale slightly from idling current. (If plate current is high even with XMTR GAIN fully counter clockwise, reduce it to idling by adjusting CARRIER BALANCE control, see "IV, Section D"). Peak the RF TUNE control for maximum plate current and quickly tune the PLATE control for a dip in plate current. When the dip is found, rotate the XMTR GAIN clockwise until the plate current no longer increases.

Depress the OUTPUT METER control and rotate it for a significant indication on the Plate Amperes meter. (This control converts the Plate Amperes meter to a Relative Output indicator and varies its sensitivity.)

Alternately adjust LOAD and PLATE controls in small increments for maximum RF output. If meter goes off scale during this process, simply reduce the sensitivity by turning the Output Meter control clockwise.

Now, release the OUTPUT METER control and adjust PLATE control slightly for plate current dip. At this point, the plate current should read between .380 and .500 Amps depending upon line voltage, antenna match, drive, tube condition, et cetera. Do not attempt to increase the LOAD control beyond the point at which maximum RF output occurs. This will result in excessive plate dissipation.

It should not be necessary to advance the LOAD control beyond 4-1/2 to obtain maximum RF output. Further advancement indicates that the SWR of the antenna system is too high and leaving the control set beyond this point is likely to result in excessive harmonic radiation.

The above procedure should be completed as quickly as possible and the FUNCTION switch should be returned to the SSB position.

Notice that when the FUNCTION switch is in the X-CW position, the screen voltage on the final amplifier tubes is reduced to prevent overheating. When the switch is on SSB, this voltage is increased so that a peak power input of 300 Watts can be obtained.

D. ADJUSTMENT OF CARRIER BALANCE CONTROL

The CARRIER BALANCE control is factory adjusted and should require a minimum of resetting under most conditions. However, it should be checked before the TR-4 is operated on SSB.

After tuning up the TR-4 as described in "IV, Section C", set the SIDEBAND switch to X, the XMTR GAIN fully counter clockwise, and the FUNCTION switch to X-CW. Now depress OUTPUT METER control and adjust the CARRIER BALANCE control (located on top of the chassis near the rear edge), for zero RF output. (If output cannot be reduced to zero, adjustment of the carrier balance capacitor may be necessary. See VIII). Return the FUNCTION switch to SSB. This completes the adjustment.

The carrier suppression provided by the crystal filters on SSB is sufficiently great that it will be impossible to adjust the balanced modulator for optimum attenuation in this mode unless a sensitive RF detector (receiver) is used in close proximity to the transceiver. We therefore recommend that balanced modulator adjustment be performed in the CW mode since the filters are not effective here. The balanced modulator should be adjusted after the unit has warmed up about 1/2 hour in order to maintain optimum balance over a prolonged period of time.

Some residual signal will occasionally be observed on the CW mode when the XMTR GAIN control is set at minimum. This is of no consequence since the additional attenuation provided on SSB will provide the desired carrier suppression.

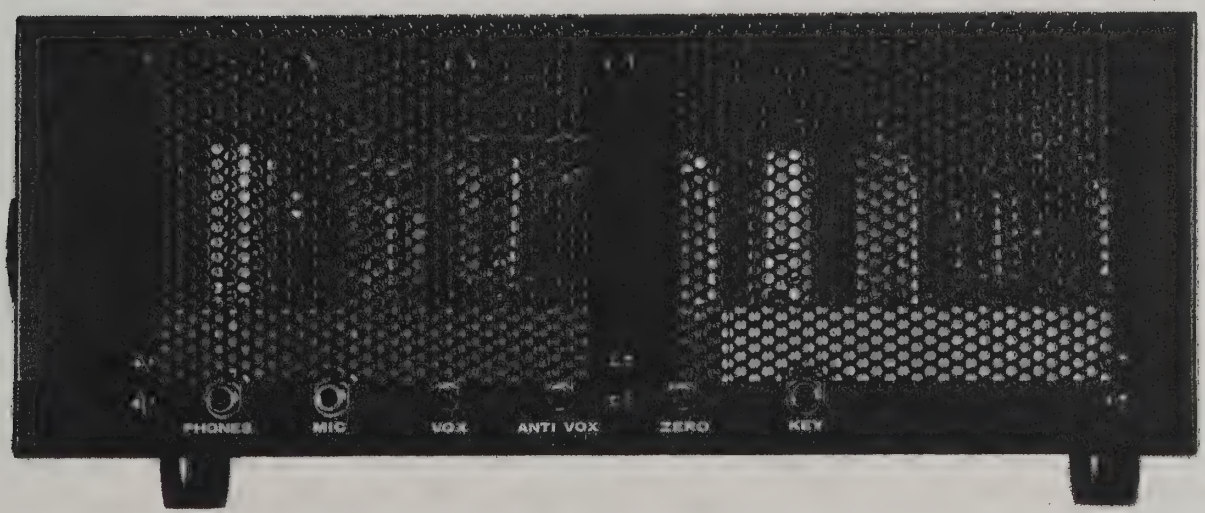


FIGURE 9. SIDE VIEW OF TR-4 TRANSCEIVER

V. OPERATION

In the following discussion, it is assumed that the TR-4 has already been tuned up on the desired band as described under "Tuning Procedure", Section IV.

A. VOICE CONTROLLED OPERATION ON SSB

Preset the controls as follows:

SIDEBAND -	On desired sideband as shown by indicator lights.
FUNCTION -	On SSB.
XMTR GAIN -	Fully counter clockwise.
RF GAIN -	Fully clockwise.
AF GAIN -	Fully counter clockwise (do not turn off power).
VOX GAIN -	Fully clockwise.
ANTI VOX -	Fully counter clockwise.

While talking into the microphone in a normal voice, increase the XMTR GAIN control until the S-meter starts kicking up scale above its resting value. (With no modulation, the S-meter will rest up scale on transmit). This indicates that the transmitting AGC is starting to work and the transmitter is peaking at maximum output. Continue talking and reduce the VOX GAIN until a point is reached where further reduction results in too frequent relay drop out.

Now increase the AF GAIN until received signals are of the desired volume. This may cause the transceiver to cycle back and forth between transmit and receive. Adjust the ANTI VOX control until the cycling stops. You are now ready to operate.

B. PUSH TO TALK OPERATION ON SSB

If the PUSH TO TALK switch on your microphone is properly connected as described under "Installation Instructions", Section II, Part D, it may be depressed at any time, thus over-riding the VOX system.

If you do not desire the VOX to function at all, turn the VOX adjust control fully counter clockwise.

REMEMBER: On SSB, the TR-4 transmits on exactly the same frequency on which it receives. Therefore, be sure that before you answer another station's CQ, or break another QSO, you have the signals tuned in so that the voices sound normal. Otherwise, you will not be transmitting exactly on frequency.

NOTE: If a key is used, it must either be closed or unplugged from the key jack for SSB and AM operation.

C. CW OPERATION

To work CW, plug your key into the KEY jack. If an electronic keyer is used, connect it for grid block keying. Leave the key in the open condition.

Note that the TR-4 uses shifted carrier CW. With this system, it is possible to transmit approximately on the received station's frequency without being zero beat while receiving. The receiver BFO is shifted from the transmitted signal frequency about 1 kHz.

To receive CW signals, place the FUNCTION switch on the X-CW position and the SIDEBAND switch in the X position. Tune in a CW signal for an audio pitch of about 1 kHz and adjust the audio gain control for pleasing volume.

To transmit, depress the key, and rotate the XMTR GAIN control clockwise just below the point at which plate current no longer increases. DO NOT ADVANCE IT BEYOND THIS POINT.

Advance the SIDETONE control on the rear of the chassis until the sidetone reaches the desired volume. (Adjusting the RCVR GAIN knob will regulate both the received signal and sidetone volume.)

The TR-4 uses automatic transmit receive switching. This means that it will automatically transmit when the key is depressed and will remain in the transmit condition through keying. It will return to the receive condition when the key is released for a brief period. If this period is too long, decrease the VOX control setting to minimum.

Manual transmit/receive switching can be accomplished by connecting an external switch (i.e. foot switch) to the push to talk circuit of the MIC jack.

D. AM OPERATION

For AM operation, the FUNCTION switch should be in the X-AM position and the SIDEBAND switch should be in the X position. If a key is used, it should be left closed or unplugged.

Tune in AM signals for most pleasing audio. This will not necessarily coincide with maximum S-meter reading.

The same procedure should be followed in setting the various gain controls for VOX operation on AM as for SSB, except that the XMTR GAIN should be adjusted for plate current peaks of from .2 to .25 Amps when talking into the microphone in a normal voice. Care should be taken to stay within these limits since the transmitting AGC does not work on AM.

TABLE OF CONTENTS

GENERAL SPECIFICATIONS 1
TRANSMITTER SPECIFICATIONS 4
RECEIVER SPECIFICATIONS 5
TUBE/TRANSISTOR FUNCTION 6

. GENERAL DESCRIPTION 7

I. INSTALLATION INSTRUCTIONS 8
A. Unpacking 8
B. Antenna 8
C. Speaker 8
D. Microphone 8
E. Location 9
F. Fixed Installation 9
G. Mobile Installation 10

II. CONTROL FUNCTIONS 16
A. Front Panel Controls 16
B. Side Controls & Jacks 18
C. Rear Controls & Jacks 19
D. Other 19

V. TUNING PROCEDURE 21
A. Bias Adjustment 21
B. Adjusting Dial Calibration 21
C. Tune-Up on Desired Band 21
D. Adjust.of Carrier Balance Control 23

V. OPERATION 24
A. VOX on SSB 24
B. PTT on SSB 24
C. CW Operation 25
D. AM Operation 25
E. General Precautions for Operation Near Band Edge 26
F. Operation with Linears 26

VI. THEORY OF OPERATION 28
A. Receiver Circuitry 28
B. Transmitter Circuitry 30

VII. SERVICE DATA 33
A. Removing Top Cover 33
B. Removing Bottom Cover 33
C. Tube Replacement 33
D. Trouble Shooting 33

VIII. ALIGNMENT INSTRUCTIONS 40
A. Xtal Calibrator Alignment 40
B. 9.0 MHz Oscillator Adjust. 40
C. Xtal Oscillator Alignment 41
D. VFO Adjustment 41
E. Adjustment of Injection Coupler 41
F. Receiving IF Alignment 41
G. Adjustment of Balanced Mod. 42
H. Filter Matching Transformers 42
I. Carrier Balance Adjustments 42
J. Adjustment of Mixer/RF Coils 43
K. Final Amplifier Neutralizing 43
L. Transmitting IF Neutralizing 44

IX. AC-4 POWER SUPPLY 45

X. DC-4 POWER SUPPLY 46
A. General Description 46
B. Specifications 46
C. Installation 46

XI. RV-4 REMOTE VFO 48
A. Removal from Cabinet 49
B. Tube Replacement 49
C. Troubleshooting 49
D. Alignment 50

XII. FF-1 FIXED FREQUENCY ADAPTER 53
A. Description 53
B. Operation 53

XIII. 34-PNB PLUG IN NOISE BLANKER 56
A. General Description 56
B. Operation 56
C. Installation 56
D. Description 58
E. Alignment 59

D. AM OPERATION (Continued)

The TR-4 uses a controlled carrier screen modulator which holds the unmodulated carrier input power to a few watts but allows 260 Watts PEP input on voice peaks. This system is compatible with SSB linear amplifiers. Due to the low duty cycle of this type AM, a linear can be run with the same PEP input as it can on SSB.

If AM reception, using product detection is desired, it will be necessary to switch the FUNCTION switch to the SSB position for receiving and back to X-AM for transmitting.

E. GENERAL PRECAUTIONS FOR OPERATION NEAR BAND EDGE

If you intend to operate near the edge of the band, be sure that you check the dial calibration as described under tuning procedure. When working SSB be sure you are using the sideband that will be inside the band i.e. lower on the high edge or upper on the low edge. On AM or CW, the transmitted carrier will be 1 kHz higher or lower than the indicated dial frequency depending upon whether the upper or lower sideband indicator light is lit.

F. OPERATION WITH LINEAR AMPLIFIERS

The TR-4 Transceiver is conservatively rated at 300 Watts PEP input. It is doubtful if it would be worthwhile to use a linear with a power rating of less than 1000 to 2000 Watts PEP input. A triode type grounded grid linear of 1000 to 2000 Watt PEP rating will present a satisfactory load for the TR-4.

If your particular linear is of the grounded cathode type with high impedance input, it will be necessary to install a resistive pad between the TR-4 and the linear that will present the proper impedance to the TR-4. Such a pad must be made of non-inductive resistors and must have adequate power handling capacity to prevent it from being destroyed when the TR-4 is turned on. Antenna switching should be accomplished as shown in Figure 2. Many linears have these relays built in.

In order to properly operate the TR-4 with a linear, proceed as follows:

1. With the TR-4 connected to the linear, tune the RF TUNE control as described under Section IV, "TUNING PROCEDURE".
2. Set the LOAD control to the setting indicated on the chart below, for the band desired, when using a linear with a 50 Ohm input.
3. Tune the PLATE control for minimum plate current.
4. Switch the FUNCTION switch to the desired mode of operation.
5. Advance the XMTR GAIN control until the desired amount of input to the linear amplifier is obtained.

Note that when the TR-4 is loaded much below maximum RF output the ALC does not function properly and flat topping in the TR-4 may result. Care

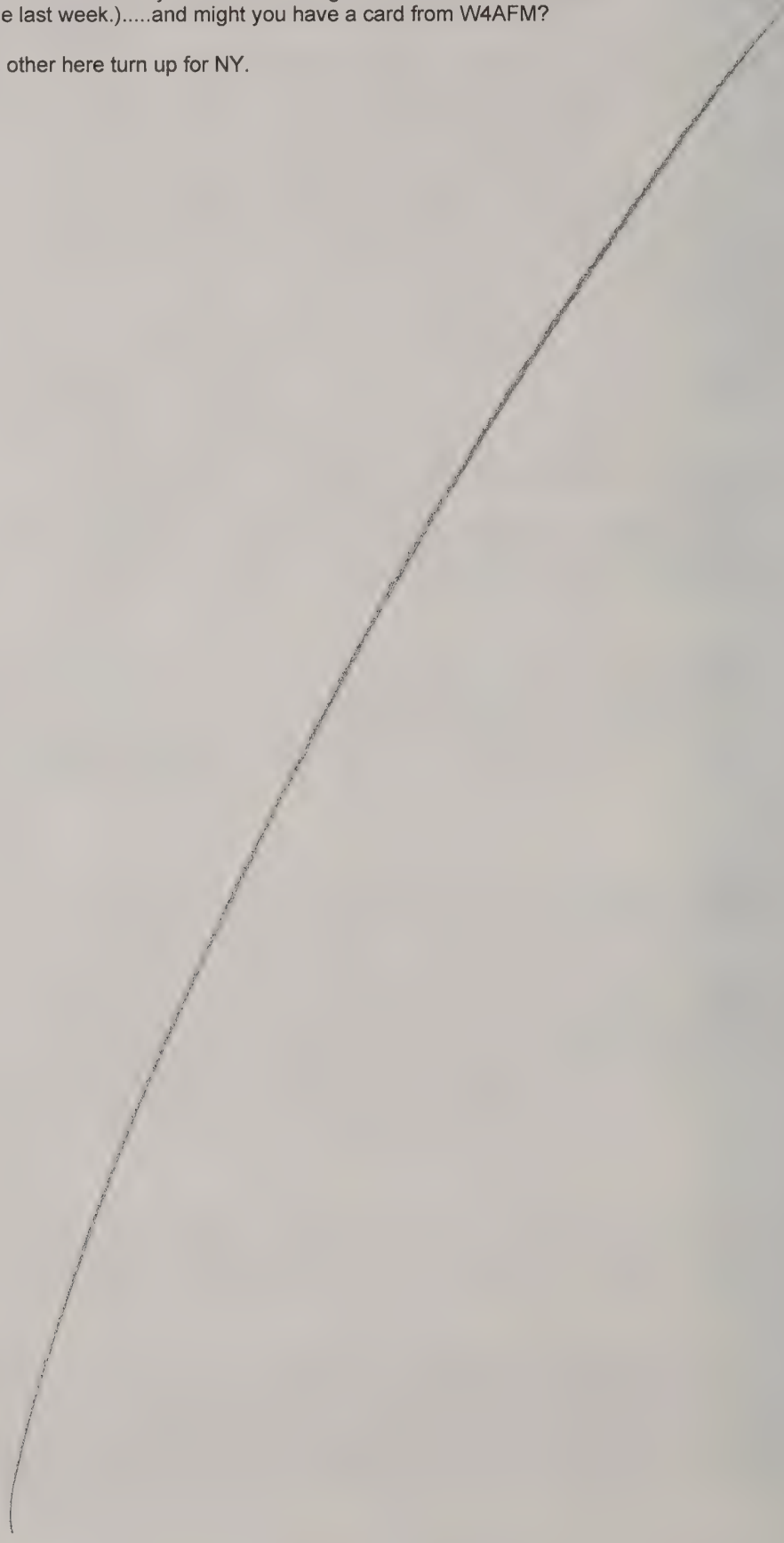
w2aww typed don fink englewood nj5/4/29..... a portable ham station 6 lbs ux-171a etc

putting all that out for you if you don't want those before WW II that is ok.. of course.

One of our guys is W4AFM's son .....he would like to know if your call books might tell when he was licensed.....26 27? Bill Hayes is his dad's name/visited him in the rest home last week.).....and might you have a card from W4AFM?

setting these aside for you, will see what the other here turn up for NY.

gud nite john travis W4QCF



tion, it may be depressed at any time, thus overriding the VOX system. If VOX operation is not desired, turn the VOX gain control fully counterclockwise.

On SSB, the TR–4C transmits on exactly the same frequency on which it receives. Therefore, be sure that you have the signals tuned in so that the voices sound normal before you answer another station's CQ, or break another QSO. Otherwise, you will not be transmitting exactly on frequency. If a key is used, it must either be closed or unplugged from the KEY jack for SSB and AM operation.

3-9. CW OPERATION.

To operate CW, connect a key to the KEY jack. If an electronic keyer is used, connect it for grid block keying. Leave the key in the open condition. The TR–4C uses shifted carrier CW. With this system, it is possible to transmit approximately on the received station's frequency without being zero beat while receiving. The transmitter BFO is shifted from the received signal frequency by approximately 1 kHz. The VFO dial reads the correct frequency of a received signal when the signal is tuned for zero beat.

To receive CW signals, place the Mode switch in the X-CW position and the SIDEBAND switch in the X position. Tune in a CW signal for an audio pitch of about 1 kHz and adjust the audio gain control knob for a normal listening level.

To transmit, depress the key, and adjust the XMTR GAIN control until it is just below the point at which plate current no longer increases. Do not advance it beyond this point. Advance the SIDETONE control on the rear of the chassis until the sidetone reaches the desired volume. Adjusting the RCVR GAIN knob controls both the received signal and sidetone level.

The TR–4C uses automatic transmit/receive switching. This means that it will automatically transmit when the key is depressed and will remain in the transmit condition during keying. It will return to the receive condition when the key is released for a brief period. If this period is too long, decrease the VOX gain. Manual transmit/receive switching can be accomplished by connecting an external switch to the push-to-talk circuit of the MIC jack.

3-10. AM OPERATION.

For AM operation, the Mode switch should be in the X-AM position and the SIDEBAND switch should be in the X position. If a key is used, it should be left closed or unplugged. Tune in AM signals for most pleasing audio. This will not necessarily coincide with maximum S meter reading. The same procedure should be followed in setting the various gain controls on AM as on SSB, except that the XMTR GAIN control should be adjusted for plate current peaks of 0.2 to 0.25 Amperes when talking into the microphone in a normal voice. Care should be taken to stay within these limits since the transmitter AGC does not operate on AM.

3-11. OPERATION NEAR BAND EDGES.

When operating near the edge of a band, be sure to check the dial calibration as described under tuning procedure. When working SSB be sure to use the sideband that will be inside the band. On AM and CW, the transmitted carrier will be 1 kHz higher or lower than the indicated dial frequency.

3-12. OPERATION WITH A LINEAR AMPLIFIER.

Since the TR–4C Transceiver is conservatively rated at 300 watts PEP input, it is doubtful if it would be worthwhile to use a linear amplifier with a power rating of less than 1000 to 2000 watts PEP input. A triode type grounded grid linear amplifier with a 1000 to 2000 watt PEP rating will present a satisfactory load to the TR–4C.

If the linear amplifier is of the grounded cathode type with high impedance input, it will be necessary to install a resistive pad between the TR–4C and the linear amplifier that will present the proper impedance to the TR–4C. Such a pad must be made of non-inductive resistors and must have adequate power handling capacity. Antenna switching should be accomplished as shown in figure 2-7. Most linear amplifiers have these relays built-in.

To properly operate the TR–4C with a linear amplifier proceed as follows:

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a. With the TR–4C connected to the linear amplifier tune the RF TUNE control as described in paragraph 3-7 g.
b. Set the LOAD control to the setting indicated on the chart below, for the band desired, when using a linear amplifier with a 50 ohm input.

BAND	50 Ohm LOAD Setting
3.5 MHz	2
7.0 MHz	3
14.0 MHz	2
21.0 MHz	3
28.5 MHz	2

c. Tune the PLATE control for minimum plate current.
d. Switch the Mode switch to the desired mode of operation.
e. Advance the XMTR GAIN control until the desired amount of input to the linear amplifier is obtained.

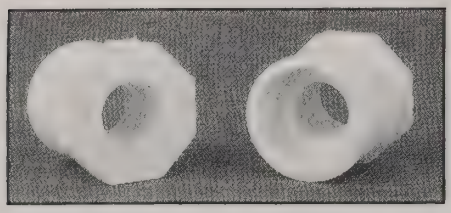
Note that when the TR–4C is loaded much below maximum RF output the AGC does not function properly and flat topping in the TR–4C may result. Care should be taken to keep the XMTR GAIN below the point where this occurs. This can be accomplished by making sure that the average peak plate current does not exceed one half of the plate current obtained on tune up.

If your linear amplifier has AGC output, connect it to the TR–4C as shown in figure 2-7. If the TR–4C is properly tuned, this should prevent flat topping on SSB regardless of the XMTR GAIN control setting. However, it will not prevent overdrive on AM since the AGC does not function in this mode.

3-13. NOVICE OPERATION.

If used on the novice bands, maximum legal input power is 250 Watts which occurs when the Plate Meter reads .385 Ampere. To realize the most useful output under these conditions, readjustment of the Bias control on the Power Supply is suggested. Follow the Bias Adjustment procedure in paragraph 3-6, except set bias control on AC–4 for .025 Ampere plate current (one fourth of the normal setting). If the transceiver is used on both novice band and by another operator on SSB or AM, the bias must be readjusted to .1 Ampere before voice operation is attempted.

To load the transmitter for novice operation, preset controls as described in paragraph 3-6. Turn the MODE switch to X–CW and advance XMTR GAIN for a very slight increase in plate current. Tune RF TUNE for a peak in plate current, being careful not to exceed .385 Ampere, and quickly tune PLATE control for a dip in plate current. Turn XMTR GAIN control fully clockwise. Adjust LOAD control clockwise and then redip the PLATE control. This procedure should be done repeatedly in small increments. Stop advancing LOAD control when plate current reaches .385 Ampere with the PLATE dipped, or when output power no longer increases, whichever occurs first. Reduce XMTR GAIN until plate current just starts to drop. The transmitter is now ready for operation.



Two of these reducers (Genova and DO-IT #30245) are needed to make the transition from 1¼-inch pipe to ½-inch pipe.

cap on one end and a 2½-inch-long dual female coupling fitted with a standard PVC 1¼-inch to ½-inch reducer (Genova and DO-IT #30245) on the other end. The reducers and couplers mate each end of the main shaft to the coil forms. You can assemble for fit, but don't glue the pieces together yet.

Center-drill both end caps. Drill the top cap on the loading coil to accept a RadioShack replacement whip assembly (RS 21-952). In the matching-coil's bottom cap, drill a hole to accept a ⅜-24 bolt for the mounting stud. Also, drill a small hole through the side of each top and bottom cap, near the top, to pass a length of #14 wire.

To the bottom of the whip and mounting bolt, attach 12-inch-long pigtails of #14 bare wire, passing the wires through their cap holes to the outside. These wires, respectively, connect the bottom of the whip to the top of the loading coil, and the mounting stud (RF feed) to a clip lead for the matching coil. Fasten the whip and the ⅜-24 bolt to their respective PVC caps, securing them tightly. Place a drop or two of thread-locking compound on the threads of the whip base in the upper cap and on the threads of the ⅜-24 bolt in the bottom cap. If either of those mounting nuts come loose once you have glued the whole thing together and wound the coils, you may—shall I say—utter a few words of disappointment! Once the connections are tight, align the flat sides of the two coil forms at the opposite ends of the main shaft and glue the entire shaft assembly. At this point, your creation starts to look like a real antenna!

Now, wind the coils. Strip a 25-foot roll of #14/2 (with ground) house wire. Wrap the wires on their respective forms, holding the turns temporarily in place with electrician's tape. The matching coil on my 20- through 6-meter antenna consists of 11 turns spaced ⅛-inch apart (a length of about 1⅞ inches). The loading coil has 25 turns spaced ⅛-inch apart for a length of approximately 3⅞ inches. Wind the third wire on the antenna shaft, spacing the turns about 1 inch to 1¼ inches apart. Don't wind the turns of the helix any closer than an inch apart, otherwise tuning the antenna on 10 and 12 meters will be a real challenge.

When the coils are wound to your liking, mix a couple of inches of epoxy putty and cut it into six strips. (Duro Epoxy Putty Sealant works well. I use the 30-minute

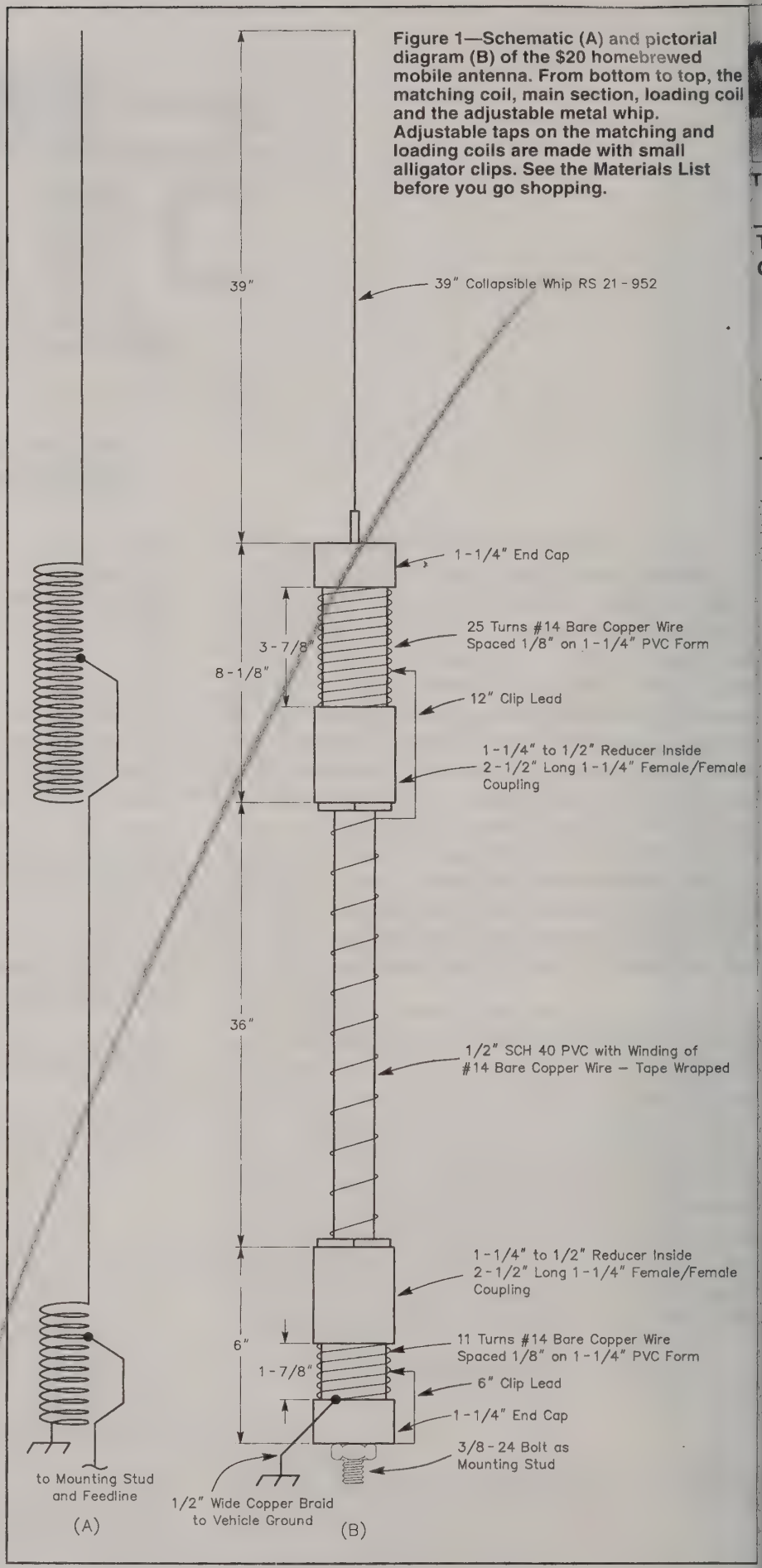


Figure 1—Schematic (A) and pictorial diagram (B) of the $20 homebrewed mobile antenna. From bottom to top, the matching coil, main section, loading coil and the adjustable metal whip. Adjustable taps on the matching and loading coils are made with small alligator clips. See the Materials List before you go shopping.

CHAPTER IV
THEORY OF OPERATION

4-1. GENERAL.

The TR–4C is a 300 Watt HF single sideband transceiver which covers the 80 through 10 meter amateur bands. AM and CW modes are also included. The TR–4C requires either an R. L. Drake AC–4, 120 V AC power supply, or an R. L. Drake DC–4, 12 V DC power supply. The TR–4C features a high-stability linear permeability tuned VFO and two 8 pole crystal lattice filters for sideband selection. Some of the circuits are common to both the transmit and receive functions. Refer to the block diagram figure 4-1 and the schematic diagram figure 5-5 as required to supplement the following discussion.

4-2. RECEIVER CIRCUITRY.

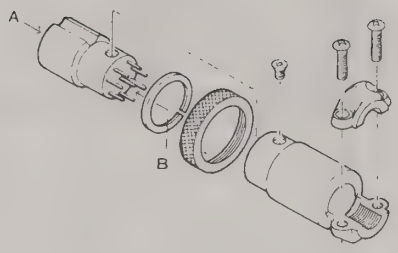
A signal entering the antenna terminal passes through the antenna switching contacts of the relay and is applied to the grid of the RF amplifier V7 through the selectivity of the L/C network formed by T9, T10 and a section of the RF TUNE capacitor C37. After being amplified, it is passed through an additional L/C network consisting of T7, T8 and the remaining section of C37, to the grid of the mixer V3B. At this point it is combined with a signal from the premixer system of the required frequency to yield a 9.0 MHz IF. The premixer system consists of a 4.9-5.5 MHz solid state permeability tuned VFO, a buffer Q2, a switchable overtone crystal oscillator V1A, the premixer pentode V1B and a cathode follower V3A.

The VFO signal output is applied to the grid of the premixer pentode through the buffer Q2 and its associated circuitry. For 80 and 20 meter operation, the VFO signal bypasses the premixer and is connected through the cathode follower to the mixer. On 40, 15 and 10 meters a signal from the crystal oscillator heterodynes with the VFO in the premixer, V1B, to produce the desired injection frequency. On 40 meters, for example, a 21.5 MHz overtone crystal and the appropriate coil L1 are switched into the crystal oscillator circuit. The output from the oscillator is coupled into the premixer pentode where it heterodynes with the 4.9-5.5 MHz VFO to produce an output frequency of 16.0-16.6 MHz. This output is coupled through the 16.0-16.6 MHz bandpass coupler, T3, and to the cathode follower, V3A. On 15 meters, a 35.5 MHz crystal is used with a 30.0-30.6 MHz coupler, T2, and on the three 10 meter ranges, 42.5, 43.0 and 43.6 MHz crystals are used with a 37.0-38.7 MHz coupler, T1.

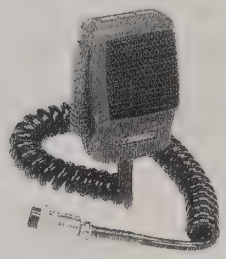
The 9.0 MHz output of the mixer, V3B, passes through the impedance matching transformer T6 into the upper or lower sideband crystal filter. The setting of the SIDEBAND knob determines which crystal filter is used. From the crystal filter the signal passes through the impedance matching transformer, T13, and is amplified by the 9 MHz receiver IF amplifier system, V11 and V12 and the IF transformers T11 and T12. The output of T12 is applied to the AGC amplifier, V13A, to the product detector, V16, and to the diode detector, V2.

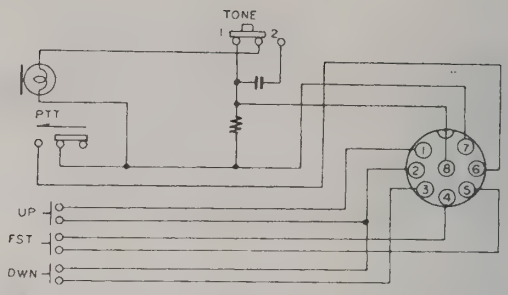
The AGC amplifier V13A is biased beyond cutoff to provide an AGC delay. When sufficient RF voltage from T12 is applied to its grid, plate current flows during part of the cycle. This causes amplified negative voltage to appear across its plate load resistor R63, thus charging C115. This negative control voltage is applied to the grids of V7, V11 and V12. C115 discharges through R63 with a time constant of approximately one second. Rotating the RF Gain control counterclockwise applies increasingly more negative bias to the AGC controlled grids, thus limiting their maximum gain.

The product detector tube, V16, consists of a 9 MHz crystal oscillator formed by the cathode, grid 1 and grid 2. A product detector is formed by the cathode, grid 3, and the plate. The IF signal is applied to grid 3 where it heterodynes with the BFO voltage in the tube. The resulting audio signal is of sufficient amplitude to drive the audio preamplifier transistor, Q5, which drives the audio output tube, V17.



Plug assembly





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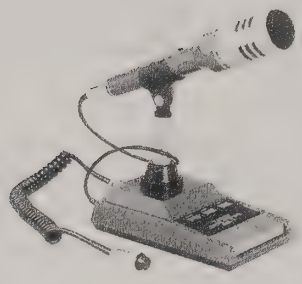
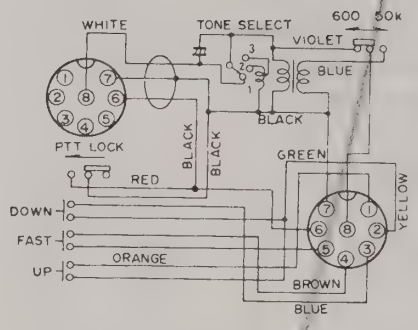
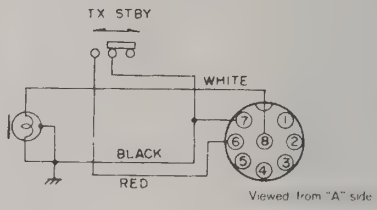
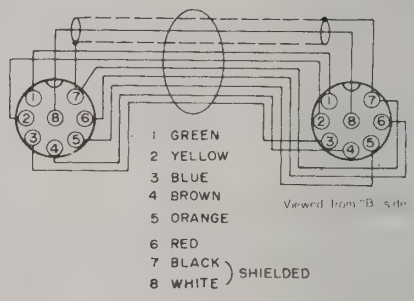


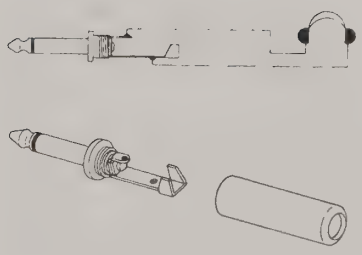


MD-1B8

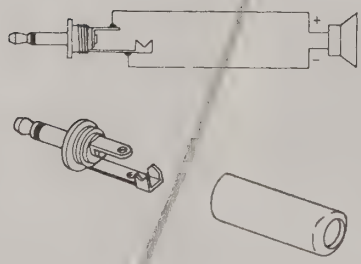




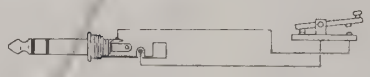
PLUG CONNECTIONS



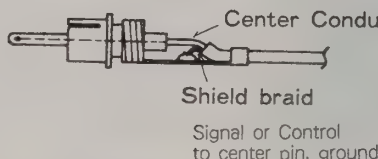
Monaural Headphone Plug



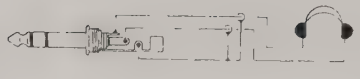
External Speaker Plug

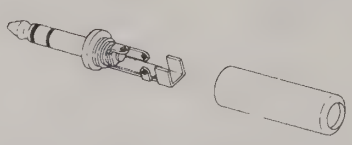


Manual key or External keyer Plug

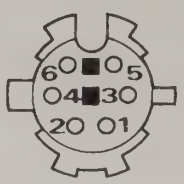


RCA Plug





Automatic Keyer (Paddle) Plug



① GND
② S. OUT
③ S. IN
④ PTT
⑤ AGC
⑥ NC

CAT (Mini-DIN) Plug

The IF signal from T12 is also applied to V2 which functions as a diode detector and an audio amplifier in the AM receive mode. The output of this stage is also fed to the Mode switch and is connected to V17 through the Audio Gain control when the Mode switch is in the X-AM position. The output of V17 is applied through the audio output transformer to the phone jack, J5, and to pin 12 of the power connector. Also, output from the plate of V17 is applied to the anti vox rectifier, D6, through the ANTIVOX control.

A 100 kHz crystal calibrator, V5, is switched on when the Mode switch is in the CAL position. Its output is coupled to the grid of the RF amplifier V7.

The S meter in the TR–4C operates in a bridge circuit with the plates of a receiver IF amplifier, V11, and the transmitter IF amplifier, V15 in one leg of the bridge and plate of the audio output tube V17 in the other leg. Receiver AGC voltage applied to V11 on receive and transmit causes these tubes to draw less current, thus unbalancing the bridge, which causes the S meter to read up scale. The bridge is balanced on receive by the ZERO control. On transmit, the meter may rest up scale with no modulation.

4-3. TRANSMITTER CIRCUITRY.

Audio input from the microphone is applied to one section of the microphone amplifier V18 where it is amplified and applied to the remaining section of this tube through one section of the XMTR GAIN control. Output from the cathode of the second triode of V18 is applied to the balanced modulator through the Mode switch for SSB operation. Output from the plate is applied to the grid of the AM screen modulator, V14, and to the grid of the first VOX amplifier triode, V19A, through the VOX control. The output from V19A is rectified by the VOX rectifier, D5, and the resulting positive DC and closing the relay when the microphone picks up audio from the speaker.

Cut off bias for the relay tube is obtained from a voltage divider. When the microphone push-to-talk switch is activated the cut off bias is grounded, causing V19B to conduct and close the relay.

RF from the 9.0 MHz crystal oscillator portion of the product detector tube V16 is applied to the balanced diode modulator through the carrier balance control. On SSB the audio from V18 is also applied to the balanced modulator and the result is a double sideband suppressed carrier signal which is applied to the transmitter IF amplifier. The amplified output is coupled through T13 to the upper or lower crystal filter where the undesired sideband is filtered out. The resulting SSB signal is coupled through T6 to the transmitter mixer, V4, where it is combined with a premixer signal of the proper frequency to give output on the desired amateur band.

Output from V4 passes through the L/C circuit, T7, T8 and C37, and is applied to the grid of the driver tube, V6. Here it is amplified and applied to the grids of V8, V9, and V10 through the L/C network, T9, T10 and the other half of C37.

Three parellel power amplifier tubes boost the signal to a power level suitable for transmission. The output impedance of the power amplifier tubes is matched to a 52 ohm load by means of the pi network circuit composed of L8, L9, C94 and C95.

At the first trace of flat topping in the final amplifier tubes, a small amount of grid current will be drawn. This produces a voltage drop across R47. The small negative going voltage thus obtained is applied through R46 to the cathode of V13B where it is amplified. The amplified negative voltage is applied to the grid of V15, thus reducing the level

FT-757GX II
HF ALL MODE
COMPUTER AIDED TRANSCEIVER

GENERAL DESCRIPTION

The FT-757GXII combines the finest features of its famous predecessor, the FT-757GX, with new developments in response to technological advances and to the most popular requests from serious hf operators. New advances in digital control and computer-aided manufacturing methods allow the FT-757GXII to offer great versatility and operator convenience on all modes and all hf amateur radio bands, with 100 watts of PEP transmitter power output on the amateur bands, and general coverage reception from 0.15 to 30 MHz.

Special new digital features include operator selectable mode-dependent tuning steps, ten memory channels which store mode as well as frequency, auto-resume loop scanning between dual VFOs (or adjacent memories), a special clarifier memory, and an improved CAT (Computer Aided Transceiver) System for simplified programming and more advanced control by an external computer.

A 40dB IF Notch filter is provided along with continuously adjustable IF Shift for minimizing interference during SSB, CW and ECSS reception of AM signals. Wideband AM and narrowband CW IF filters are included as standard. A switchable RF amplifier and 20dB attenuator are provided to optimize sensitivity and dynamic range on all frequencies under a wide variety of conditions, while the noise blanking pulse width can be set on the front panel, continuously adjustable from narrow (ignition-type) to wide ("woodpecker") blanking pulse widths.

Full break-in QSK CW operation is provided with Yaesu's custom-designed electronic keyer built in, as a standard feature. New high voltage solid state transmit/receive switching circuitry is provided for direct t/r control of a

product detector tube V16, through the SIDETONE control, to provide audio output from the speaker for CW monitoring. Audio output from V2 is also applied to the grid of the VOX amplifier tube, V19A, which causes relays K1 and K2 to close. The relays turn on the transmitter, cause the 9.0 MHz oscillator to be shifted to 9.001 MHz and apply a variable source of DC, controlled by half of the XMTR GAIN control, to the balanced modulator. The DC voltage which unbalances the modulator increases the carrier to a suitable level. The resulting 9.001 MHz signal from the balanced modulator is amplified by V15 and coupled into the crystal filter. The SIDEBAND control must be in the "X" position to allow the signal to pass. A screen resistor is switched into the final amplifier screen circuit to prevent excessive screen current in the X-CW position of the Mode switch.

When the Mode switch is placed in the X-AM position the AM screen modulator V14 is inserted in series with the final amplifier screen supply and a constant voltage is applied to the balanced modulator. Relay K2 shifts the 9 MHz oscillator to 9.001 on transmit just as it does on X-CW. Vox and PTT functions are the same on AM as on SSB.

When relay K1 is closed, either by the VOX circuit or the push-to-talk switch, the cathode of V3B, V7, V11 and V12 are isolated from ground which disables the receiver. The cathodes of V4, V6, V8, V9, V10 and V15 are connected to ground which actuates the transmitter. Also, the antenna is switched from the receiver input to the final amplifier tank circuit. If the TCVR/RCVR switch is in the RCVR position, the RCVR MUTE jack is grounded through RFC 11 and RFC 7 and the antenna is connected to the RCVR ANT jack instead of T9 in the receive condition of the relays.

Pushing in the LOAD control disconnects the plate current meter from the final amplifier cathode circuit and connects it to the diode D9 and its associated circuitry. This network samples the RF output voltage at the antenna connection, rectifies it, and applies it across the meter.

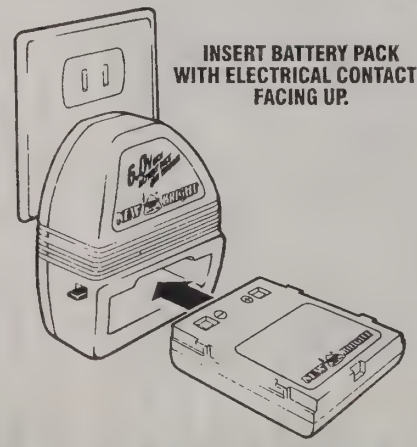
CAUTION-ELECTRICALLY OPERATED PRODUCT: NOT RECOMMENDED FOR CHILDREN UNDER 8 YEARS OF AGE. AS WITH ALL ELECTRIC PRODUCTS, PRECAUTIONS SHOULD BE OBSERVED DURING HANDLING AND USE TO PREVENT ELECTRIC SHOCK. INPUT: 120 VAC, 60Hz, 3W. OUTPUT: 7 VDC, 150mA.

6.0V POWER CHARGE NiCd BATTERY PACK & QUICK CHARGER

OPERATING INSTRUCTIONS

CHARGE BATTERY BEFORE USE.

- Plug the quick charger into a standard 110/120V indoor electrical outlet.
- Insert the 6.0V NiCd rechargeable battery pack securely into the charger as shown. Allow battery to charge for a minimum of four hours. Charging for more than four hours will not increase running time.
- Lift button located on the side of the charger while removing the battery as shown.
- Charge will last approximately 15-20 minutes depending on the intensity of use and the specific toy.
- IMPORTANT: It is normal for the battery pack to become warm after charging and/or use. Be sure to allow the battery pack to cool before recharging. Recharging a warm battery pack will greatly reduce the battery life.



CAUTION:
DO NOT CHARGE BATTERY IF IT OR THE CHARGER ARE WET.
DO NOT RECHARGE BATTERY PACK IF IT IS HOT.
ALLOW BATTERY PACK TO COOL BEFORE RECHARGING.
PERIODICALLY INSPECT BATTERY PACK FOR LEAKAGE OR CORROSION.
DO NOT ATTEMPT TO DISASSEMBLE THE BATTERY PACK.
DO NOT RECHARGE IF DAMAGED.
DO NOT INCINERATE.
RECYCLE OR DISPOSE OF PROPERLY. NiCd

QUALITY TOYS
NEW BRIGHT

L519100665/JN348-98

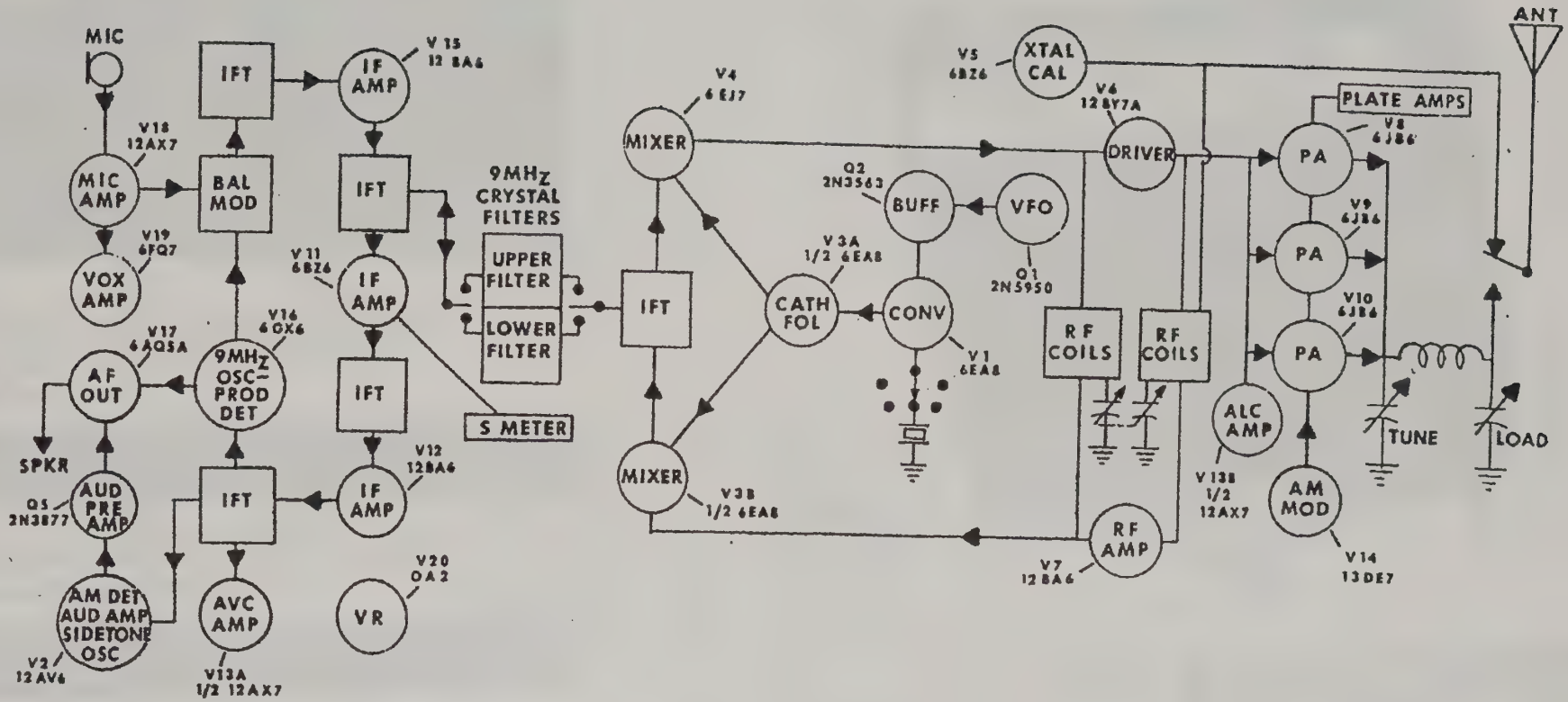


Figure 4–1. Block Diagram

TROUBLE SHOOTING AND CARE FOR R/C VEHICLES

PROBLEM! *VEHICLE DOES NOT MOVE*

e the + and –'s contacts correctly matched in transmitter?
e the metal contact tabs touching, rusty or dirty in transmitter?
e there batteries in vehicle and transmitter?
he power switch on vehicle turned on?
he battery/power pack weak or out of power?

PROBLEM! *VEHICLE MOVES BY ITSELF*

ere is radio interference in the area.
other R/C vehicle with the same frequency is close by.

PROBLEM! *VEHICLE RUNS SLOWLY*

battery is weak or fading.
power pack is worn out and needs to be replaced.
teries are not Alkaline, are miss matched or are old.

IF VEHICLE HAS A NOTICEABLE DROP IN PERFORMANCE, INCONSISTENT MOVEMENT, OR JUST FAILS TO RUN, RECHARGE BOTH PACK AND BATTERIES. IF PROBLEM PERSISTS, REPLACE BATTERIES.

Battery charger & battery pack need to be periodically mined for potential hazards and that any potentially ardous parts be repaired or replaced.

QUALITY TOYS
NEW BRIGHT

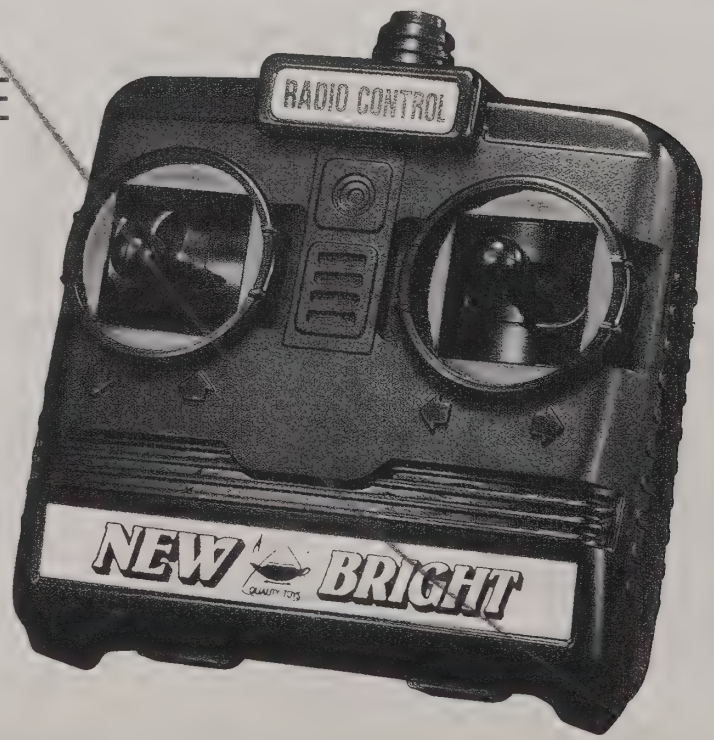
CAUTION-ELECTRICALLY OPERATED PRODUCT. NOT RECOMMENDED FOR CHILDREN UNDER 8 YEARS OF AGE. AS WITH ALL ELECTRIC PRODUCTS, PRECAUTIONS SHOULD BE OBSERVED DURING HANDLING AND USE TO PREVENT ELECTRIC SHOCK

6.0V

OPERATOR'S MANUAL

FULL FUNCTION RADIO CONTROL

1:16 SCALE



NOTE
Vehicle ANTENNA is packed in shipping foam in box.

Battery Requirements:
1-9V Alkaline
1-6.0V Rechargeable Power Pack-Charger

L614100117/JN368-98

CHAPTER V
MAINTENANCE

5-1. SERVICE DATA.

We will check and align your transceiver at the factory for a nominal fee if it has not been tampered with. Transportation charges are extra. Any necessary repairs will be made on a time and material basis. Please write or call the factory for authorization before returning your unit for alignment or service. Address your request for authorization to:

R. L. Drake Company
540 Richard Street
Miamisburg, Ohio 45342
ATTN: Customer Service Department
Telephone: (Area Code 513) 866-3211
(Code-A-Phone Service after 1630 Hours E.S.T.)

WARNING

Extreme caution should be exercised when the top and bottom covers are removed. High voltage which is present at several points can cause a lethal electrical shock. Repairs and adjustments should be made only by a qualified electronics technician. Disconnect the Power Supply from the TR-4C before removing covers.

5-2. TOP COVER REMOVAL.

Remove the three top screws on each side of the TR-4C and remove the cover by first pulling up on the rear and then the front of the cabinet.

5-3. BOTTOM COVER REMOVAL.

Remove the three bottom screws on each side of the TR-4C and lift the chassis out of the bottom cover.

5-4. TUBE REPLACEMENT.

In general, most trouble in electronic equipment of good design is due to tube failure. The best method of finding defective tubes is by direct substitution. It is best not to rely too heavily on tube checkers. The TR-4C has been designed so that, with the exception of V8, V9 and V10, tubes can be replaced without need for realignment. These tubes are to be replaced with a matched set of the same brand as originally supplied. If a different brand is used, alignment of T7, T8, T9 and final amplifier neutralization is recommended. Matched sets of Sylvania 6JB6's are available directly from the factory. To replace the 6JB6 tubes, it is necessary to remove only the top of the final amplifier cage. To do this, remove the sheet metal screws holding the PA cover to the cage. A disc-handle is provided on the cover to facilitate removal. To replace the PA cover, simply reverse the process. Be sure the parasitic suppressors do not short to the cage.

5-5. TROUBLE SHOOTING.

Careful consideration has been given in the design of the TR-4C to keep maintenance problems to a minimum. However, it is quite possible that some problem will arise which cannot be cured by tube substitution. If this occurs, it is suggested that the TR-4C be returned to the dealer or you may write to the Customer Service Department at the address given in paragraph 5-1. Be sure to describe the problem in detail. Include full information concerning external connections, control settings, tubes substituted, serial number, etc. Always include the serial number when requesting service information. Before returning equipment to the factory, it is necessary to get prior authorization. In case of malfunction, first check the power supply fuse, the filament fuse in the TR-4C and the number 12 fuse lamp near the relay assembly for continuity. The voltage and resistance charts in this chapter should be valuable in isolating minor problems.

TROUBLE SHOOTING AND CARE FOR R/C VEHICLES

PROBLEM: VEHICLE DOES NOT MOVE

- the + and –'s contacts correctly matched in transmitter?
- the metal contact tabs touching, rusty or dirty in transmitter?
- there batteries in vehicle and transmitter?
- ne power switch on vehicle turned on?
- ne battery/power pack weak or out of power?

PROBLEM: VEHICLE MOVES ERRATICALLY

- re is radio interference in the area.
- other R/C vehicle with the same frequency is close by.

PROBLEM: VEHICLE RUNS SLOWLY

- battery is weak or fading.
- power pack is worn out and needs to be replaced.
- teries are not Alkaline, are miss matched or are old.

IF VEHICLE HAS BEEN EXPOSED TO WATER

[redacted]

[redacted]

Battery charger & battery pack need to be periodically mined for potential hazards and that any potentially ardous parts be repaired or replaced.

QUALITY TOYS

NEW BRIGHT

CAUTION-ELECTRICALLY OPERATED PRODUCT: NOT RECOMMENDED FOR CHILDREN UNDER 8 YEARS OF AGE. AS WITH ALL ELECTRIC PRODUCTS, PRECAUTIONS SHOULD BE OBSERVED DURING HANDLING AND USE TO PREVENT ELECTRIC SHOCK

OPERATOR'S MANUAL

FULL FUNCTION RADIO CONTROL

1:16 SCALE

NOTE

Vehicle ANTENNA is packed in shipping foam in box.

Battery Requirements:
1-9V Alkaline
1-6.0V Rechargeable Power Pack-Charger

L614100117/JN368-98

However, no attempt should be made to service the TR–4C unless you are thoroughly familiar with electronic circuitry and servicing technique. Care should be taken not to disturb the lead dress in the TR–4C since several circuits are quite critical in this regard.

5-6. TEST EQUIPMENT.

Alignment of TR–4C will require the following equipment:

a. A general coverage receiver capable of receiving WWV.
b. An 11 Megohm VTVM.
c. An alignment load consisting of a 1000 Ohm non-inductive resistor in series with a .005 uF disc ceramic capacitor.
d. A 52 Ohm dummy load.

WARNING

Before receiver alignment is attempted, the plate and screen power leads of the amplifier tubes should be disconnected where they pass through the partition under the chassis. Be sure the power is disconnected before this is attempted, or serious electrical shock may result.

5-7. ALIGNMENT PROCEDURES.

5-8. CRYSTAL CALIBRATOR. To align the crystal calibrator perform the following steps:

a. Let the TR–4C warm up for 30 minutes.
b. Preset the XMTR GAIN control fully counter-clockwise.
c. Set the Mode switch to CAL.
d. Tune in WWV on the general coverage receiver with the BFO off.
e. Connect a wire from the receiver antenna terminal to V5 of the TR–4C. Wrap the wire around the tube a turn or two.
f. Adjust C45, located on top of the TR–4C chassis, until the calibrator signal is zero beat with the unmodulated WWV carrier.

5-9. 9.0 MHz OSCILLATOR.

a. Let the TR–4C warm up for 30 minutes.
b. Set the Mode switch in the SSB position.
c. Turn up the Audio Gain control until noise is audible in the speaker.
d. While switching the SIDEBAND knob back and forth, adjust C130, located on top of the chassis near the rear edge, until the pitch of the noise is the same on both positions.

5-10. INJECTION CRYSTAL OSCILLATOR.

a. Set the VTVM to its lowest DC negative volt scale and set the pointer to about center scale with VTVM zero adjust control.
b. Connect the common lead of the VTVM to the TR–4C chassis and the DC lead to the test point which is connected to pin 9 of V1.
c. Set BAND switch to 7.0 MHz and adjust L1 for maximum negative DC voltage.
d. Switch to 21.0 MHz and adjust L5 for maximum as in Step c.
e. Switch to 29.1 MHz and adjust L2 for maximum as in Step c.
f. The 28.0, the 28.5 and the 29.1 MHz positions should have about the same negative voltage.

5-11. VFO ADJUSTMENT.

The permeability tuned VFO was carefully adjusted at the factory and should require no further alignment. If it does not appear to track from one end of its range to the other, it should be returned to the factory for realignment. Maximum calibration error is 1 kHz when calibrated to the nearest 100 kHz point.

5-12. INJECTION COUPLER.

a. Tune in a crystal calibrator signal at 7.3 MHz.
b. Connect the alignment load between pin 6 of V1B and ground and adjust T3 (top) for maximum S meter reading.
c. Connect the load from pin 9 of V3A and ground and adjust T3 (bottom) for maximum S meter reading.
d. Tune in a crystal calibrator signal at 21.300 MHz and repeat the procedure for T2.
e. Tune in a crystal calibrator signal at 29.000 MHz and repeat the above procedure for T1. *Note:* On T1, adjust the bottom slug when the load is on pin 6 of V1B and the top slug when the load is on pin 9 on V3A.

TROUBLE SHOOTING AND CARE FOR R/C VEHICLES

[redacted]

re the + and –'s contacts correctly matched in transmitter?
re the metal contact tabs touching, rusty or dirty in transmitter?
re there batteries in vehicle and transmitter?
the power switch on vehicle turned on?
the battery/power pack weak or out of power?

[redacted]

here is radio interference in the area.
nother R/C vehicle with the same frequency is close by.

[redacted]

he battery is weak or fading.
he power pack is worn out and needs to be replaced.
atteries are not Alkaline, are miss matched or are old.

[redacted]

[redacted]

he Battery charger & battery pack need to be periodically xamined for potential hazards and that any potentially azardous parts be repaired or replaced.

QUALITY TOYS

NEW BRIGHT

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[redacted]

OPERATOR'S MANUA

FULL FUNCTION RADIO CONTROL

1:16 SCALE

NOTE

Vehicle ANTENNA is packed in shipping foam in box.

Battery Requirements:
1-9V Alkäline
1-6.0V Rechargeable Power Pack-Charger

L614100117/JN368-98

Table 5–1. Resistance Chart

REF DES	Tube Type	MEASURED AT PIN 1	2	3	4	5	6	7	8	9
V1	6EA8	9.5 K	2.5 Meg	20 K	0	Fil	9.6 K	220	220	150 K
V2	12AV6	3.3 Meg	Inf.	Fil	0	150 K	150 K	350 K	—	—
V3	6EA8	8.0 K	150 K	250 K	Fil	0	11 K	2.2 K	1 K	34 K
V4	6EJ7	25 K	660 K	23 K	Fil	0	0	11 K	9.5 K	0
V5	6BZ6	1 Meg	1 K	Fil	0	350 K	125 K	1 K	—	—
V6	12BY7A	25 K	67 K	0	0	0	Fil	8.5 K	25 K	0
V7	12BA6	2.8 Meg	0	Fil	0	11 K	10K	100	—	—
V8	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V9	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V10	6JB6	8.2 K	40 K	23 K	Fil	Fil	40 K	8.2 K	0	23 K
V11	6BZ6	2.5 Meg	150	0	Fil	10 K	13 K	0		
V12	12BA6	2.5 Meg	0	Fil	0	10 K	13 K	68		
V13	12AX7	1 Meg	22 K	45 K	0	0	2.2 Meg	55 K	48 K	Fil
V14	13DE7	8 K	2.5 Meg	2.5 Meg	Fil	0	2.2 Meg	22 Meg	0	Inf.
V15	12BA6	2 Meg	0	0	Fil	10 K	13 K	25 K	—	—
V16	6GX6	2.2 Meg	1 K	0	Fil	250 K	9.2 K	22 K	—	—
V17	6AQ5	500 K	270	0	Fil	8.7 K	8 K	500 K		
V18	12AX7	350 K	6.8 Meg	0	0	Fil	350 K	500 K	3.3 K	N. C.
V19	6FQ7	12 K	4.5 Meg	0	Fil	0	100 K	620 K	820	1.6 Meg
V20	OA2	7.8 K	0	Inf.	0	7.8 K	Inf.	0		

REF DES	Transistor Type	MEASURED AT: Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	5.6 K	43 K
Q4	2N3394	0	750	1.1 K
Q5	2N3877	1 K	56 K	6.8 K

NOTE:
All measurements were made with respect to ground with the power supply disconnected from the TR 4C. The BAND switch was on 7.0 MHz, the Mode switch was on CAL and the RCVR GAIN and XMTR GAIN controls were fully clockwise. The VOX, ANTI VOX and SIDETONE controls were fully clockwise and the ZERO control was set at the balance point. The accessory 34 PNB jumper plug was in the noise blanker jack.

GENERAL SPECIFICATIONS

FREQUENCY COVERAGE
Full coverage on all amateur bands 10 through 80 meters, in seven 600 kHz ranges: 3.5 to 4.1 MHz, 7.0 to 7.6 MHz, 13.9 to 14.5 MHz, 21.0 to 21.6 MHz, 28.0 to 28.6 MHz, 28.5 to 29.1 MHz, 29.1 to 29.7 MHz.

SOLID STATE VFO
Has linear permeability tuning. Tunes 4.9 to 5.5 MHz for all ranges.

DIAL CALIBRATION
10 kHz divisions on Main Tuning dial and 1 kHz on tuning knob skirt. Effective length of circular dial scale is over 14 inches.

FREQUENCY STABILITY
High stability solid state VFO tunes same range on all bands. Overall drift is less than 100 Hz after warm-up, and less than 100 Hz for ± 10% line voltage change.

MODES OF OPERATION SSB (Upper or Lower Sideband), CW, and AM.

FRONT PANEL CONTROLS

MAIN TUNING
Fluted knob with adjustable 25 division skirt. Tunes VFO and rotates main dial.

RF TUNE
Tunes the RF circuits common to receiver RF amplifier and transmitter driver stages. 0 - 10 scale.

PLATE AND LOAD
These tuning controls adjust pi-network capacitors in transmitter for proper resonance and loading on each band.

BAND
This switch selects desired ham band (see "Frequency Coverage" above).

FUNCTION
This switch has four positions; CAL, SSB, X-CW, X-AM.

1. CAL operates built-in 100 kHz crystal calibrator for accurate setting of Main Tuning hair line indicator and knob skirt.
2. SSB provides SSB operation, either VOX or PTT.
3. X-CW provides for CW operation with automatic transmit receive switching and CW sidetone, and is used for tune up.
4. X-AM provides controlled carrier AM operation with VOX or PTT, and with diode detector for receiving.

Table 5–2. Voltage Chart

REF DES	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	122	–2	125	0	6.3*	250 245	2.6	2.6	–1.3
V2	12AV6	0 –1.6	13.0 0	12.6*	0	0 0.9	0 0.9	255 122		
V3	6EA8	155 150	0	98 150	6.3*	0	260 250	3.5 150	17 15.5	17 15.2
V4	6EJ7	155 2.8	0	NC	6.3*	0	0	270 230	175 145	
V5	6BZ6	–42 0	0.9 23	12.6*	6.3*	70 140	58 144	0.9 23		
V6	12BY7A	155 3.3	0	NC	0	0	6.3*	265 240	262 165	0
V7	12BA6	–.14	0	12.6*	0	235 230	98 110	1.25 150		
V8	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V9	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V10	6JB6	262 250	–60	155 1.0	6.3*	12.6*	–60	262 250	0	155 0.4
V11	6BZ6	–.16	1.6 150	0	6.3*	235	125 150	0		
V12	12BA6	–.16	0	12.6*	0	240	105 150	1.1 150		
V13	12AX7	–.1 0	–61 –61	–59 –59	0	0	–.16	–61 –61	–59 –58	6.3*
V14	13DE7	260 250	11.4 11.2	11.4 11.2	12.6*	0	11.4 11.2	–1.0 –1.0	0	64 53
V15	12BA6	0	0	0	12.6*	248 140	155 144	155 1.3		
V16	6GX6	–6.0 –5.6	4.0	0	6.3*	140 140	140	0		
V17	6AQ5	0	7.2 6.8	0	6.3*	240 230	155 150	NC		
V18	12AX7	88 87	–.75	0	0	12.6*	130 125	0	1.23 1.1	NC
V19	6FQ7	240 165	–9.5 0	0	6.3*	0	67 87	0	1.5 1.27	TP
V20	OA2	146	NC	NC	NC	NC	NC	0		

CHARTS AND ILLUSTRATIONS

FIGURE		PAGE
1	Front View	7
2	Connecting TR-4 to AC-4	11
3	Connecting TR-4 to Linear Amplifier	12
3.1	Connecting TR-4, T-4X to Linear Amplifier	12
4	Using TR-4 with External Receiver	13
5	Electrical Connections for Mobile Installation of TR-4	13
6	Mechanical Details of Mobile Installation	14
7	Viewing Angle Options	15
8	Rear View	20
9	Side View	23
10	Attenuators for Using TR-4 with Linear Amplifier	27
11	Typical Selectivity Curve - Crystal Filters	32
11A	Block Diagram	32
12	Resistance Chart	35
13	Voltage Chart	36
14	Top View	38
15	Bottom View	39
16	Schematic Diagram - AC-4 Power Supply	45
17	Schematic Diagram - DC-4 Power Supply	47
18	Schematic Diagram - RV-4 Remote VFO	52
19	FF-1 Mounted Under TR-4	53
20	FF-1 Fixed Frequency Adapter Schematic	54
21	TR-4 Schematic (fold out page)	55
22	Noise Blanker Block Diagram	57
23	Circuit Board Layout, 34-PNB	60
24	34-PNB Noise Blanker Schematic (fold out page)	60

FIGURE 12.

RESISTANCE CHART

Ident No.	Tube Type	MEASURED AT PIN 1	2	3	4	5	6	7	8	9
V1	6EA8	9.5K	2.5Meg	20K	0	Fil	9.6K	220	220	150K
V2	12AV6	3.3Meg	Inf.	Fil	0	150K	150K	350K	---	---
V3	6EA8	8.0K	150K	250K	Fil	0	11K	2.2K	1K	34K
V4	6EJ7	25K	660K	23K	Fil	0	0	11K	9.5K	0
V5	6BZ6	1Meg	1K	Fil	0	350K	125K	1K	---	---
V6	12BY7A	25K	67K	0	0	0	Fil	8.5K	25K	0
V7	12BA6	2.8Meg	0	Fil	0	11K	10K	100	---	---
V8	6JB6	8.2K	40K	23K	Fil	Fil	40K	8.2K	0	23K
V9	6JB6	8.2K	40K	23K	Fil	Fil	40K	8.2K	0	23K
V10	6JB6	8.2K	40K	23K	Fil	Fil	40K	8.2K	0	23K
V11	6BZ6	2.5Meg	150	0	Fil	10K	13K	0	---	---
V12	12BA6	2.5Meg	0	Fil	0	10K	13K	68	---	---
V13	12AX7	1Meg	22K	45K	0	0	2.2Meg	55K	48K	Fil
V14	13DE7	8K	2.5Meg	2.5Meg	Fil	0	2.2Meg	22Meg	0	Inf
V15	12BA6	2Meg	0	0	Fil	10K	13K	25K	---	---
V16	6GX6	2.2Meg	1K	0	Fil	250K	9.2K	22K	---	---
V17	6AQ5	500K	270	0	Fil	8.7K	8K	500K	---	---
V18	12AX7	350K	6.8Meg	0	0	Fil	350K	500K	3.3K	N.C.
V19	6EV7	13K	4.5Meg	0	Fil	0	110K	450K	820	1.5Meg
V20	OA2	7.8K	0	Inf	0	7.8	Inf	0	---	---

Identification Number	Transistor Type	Measured At: Emitter	Base	Collector
Q1	2N5950	Located in PTO		
Q2	2N3563	Located in PTO		
Q3	AT5059	0	5.6K	43K
Q4	2N3394	0	750	1.1K
Q5	2N3877	1K	56K	6.8K

NOTE:

All measurements were made from ground with the power supply disconnected from the TR-4. The BAND switch was on 40 meters, the FUNCTION switch was on CAL, and the RCVR GAIN and XMIT GAIN controls were fully clockwise. The VOX, ANTI VOX and SIDETONE controls were fully clockwise, and the ZERO control was set at the balance point. The accessory 34-PNB jumper plug was in the noise blanker jack.

FRONT PANEL CONTROLS (Continued)

XMTR GAIN
Functions as mike audio gain on SSB and AM, and as carrier injection control on CW.

RCVR GAIN
Knob controls receiver AF Gain and Power ON-OFF switch. Lever behind knob. controls setting of RF Gain.

SIDEBAND
Switch in conjunction with indicator lights marked "Upper" and "Lower", selects desired sideband by connecting into the circut either the upper or lower sideband filter. ("X" position used when in "X-CW" or "X-AM" positions of Function Switch.)

OUTPUT METER CONTROL
This switch converts plate meter to read relative output, when pushed. Rotating varies output meter sensitivity.

RIGHT SIDE SCREWDRIVER ADJUST CONTROLS
Vox Gain, Anti Vox Gain, S-Meter Zero.

RIGHT SIDE JACKS
Headphone (disconnects speaker circuit), Microphone (3-circuit for PTT), Key (normally closed).

REAR CONTROLS
Sidetone (adjusts sidetone volume), Lights (for dimming dial lights).

REAR JACKS
POWER (connects TR-4 to power supply and speaker),
RCVR MUTE (for muting an external receiver),
RCVR ANT (Uses TR-4 antenna relay to connect an external receiver to antenna),
ANTENNA (for connecting the TR-4 to the antenna).

LEFT SIDE CONTROLS
TCVR/RCVR switch (for selecting between the use of the TR-4 or an external receiver for receiving).

INSIDE CONTROLS
Carrier Balance

FIGURE 13. VOLTAGE CHART

Ident. No.	Tube Type	MEASURED AT PIN								
		1	2	3	4	5	6	7	8	9
V1	6EA8	122	-2	125	0	6.3*	250 245	2.6	2.6	-1.3
V2	12AV6	0 -1.6	13.0 0	12.6*	0	0 0.9	0 0.9	255 122	---	---
V3	6EA8	155 150	0	98 150	6.3*	0	260 250	3.5 150	17 15.5	17 15.2
V4	6EJ7	155 2.8	0	NC	6.3*	0	0	270 230	175 145	---
V5	6BZ6	-42 0	0.9 23	12.6*	6.3*	70 140	58 144	0.9 23	---	---
V6	12BY7A	155 3.3	0	NC	0	0	6.3*	265 240	262 165	0
V7	12BA6	-.14	0	12.6*	0	235 230	98 110	1.25 150	---	---
V8	6JB6	262 250	-60	155 1.0	6.3*	12.6*	-60	262 250	0	155 0.4
V9	6JB6	262 250	-60	155 1.0	6.3*	12.6*	-60	262 250	0	155 0.4
V10	6JB6	262 250	-60	155 1.0	6.3*	12.6*	-60	262 250	0	155 0.4
V11	6BZ6	-.16	1.6 150	0	6.3*	235	125 150	0	---	---
V12	12BA6	-.16	0	12.6*	0	240	105 150	1.1 150	---	---
V13	12AX7	-.1 0	-61 -61	-59 -59	0	0	-.16	-61 -61	-59 -58	6.3*
V14	13DE7	260 250	11.4 11.2	11.4 11.2	12.6*	0	11.4 11.2	-1.0 -1.0	0	64 53
V15	12BA6	0	0	0	12.6*	248 140	155 144	155 1.3	---	---
V16	6GX6	-6.0 -5.6	4.0	0	6.3*	140 140	140	0	---	---
V17	6AQ5	NC	7.2 6.8	0	6.3*	240 230	155 150	0	---	---
V18	12AX7	88 87	-.75	0	0	12.6*	130 125	0	1.23 1.1	NC
V19	6EV7	260 180	-6 -.36	0	6.3*	0	103 110	0	1.25 1.20	TP
V20	OA2	146	NC	NC	NC	NC	NC	0	---	---

FRONT PANEL CONTROLS (Continued)

METERS

Receiver - S-Meter/Transmitting AGC Indicator, and
Transmitter - Plate Ammeter/Relative RF Output Indicator.

MISCELLANEOUS

Twenty tubes including voltage regulator; five transistors, ten diodes; one 100 kHz crystal calibrator built-in.

DIMENSIONS

5-1/2" High
10-3/4" Wide
14-3/8" Deep

WEIGHT

16 pounds

FIGURE 13. (Continued)

Identification Number	Transistor Type	Measured At:		
		Emitter	Base	Collector
Q1	2N5950	Located	in PTO	
Q2	2N3563	Located	in PTO	
Q3	AT5059	0	0	61
Q4	2N3394	0	11.2	0
Q5	2N3877	2.3	2.8	48

NOTE:

All measurements were made with an 11 Megohm VTVM and were taken from ground. RF TUNE, PLATE and LOAD controls were set as described under Section IV, "TUNING PROCEDURE". BAND switch was on 40 meters, MAIN TUNING was at 7.250 MHz and SIDEBAND was on "X". Receive measurements were made with the FUNCTION switch in the CAL position and transmit measurements were made with the FUNCTION switch in the X-CW position, with the following exception:

On V14, both receive and transmit measurements were made with the FUNCTION switch in the X-AM position and with the PTT grounded for transmit.

The AC-4 Power Supply was used. Where two voltages are shown, the top is for receive and the bottom is for transmit. An "*" indicates AC voltage. The accessory 34-PNB jumper plug was in the noise blanker jack.

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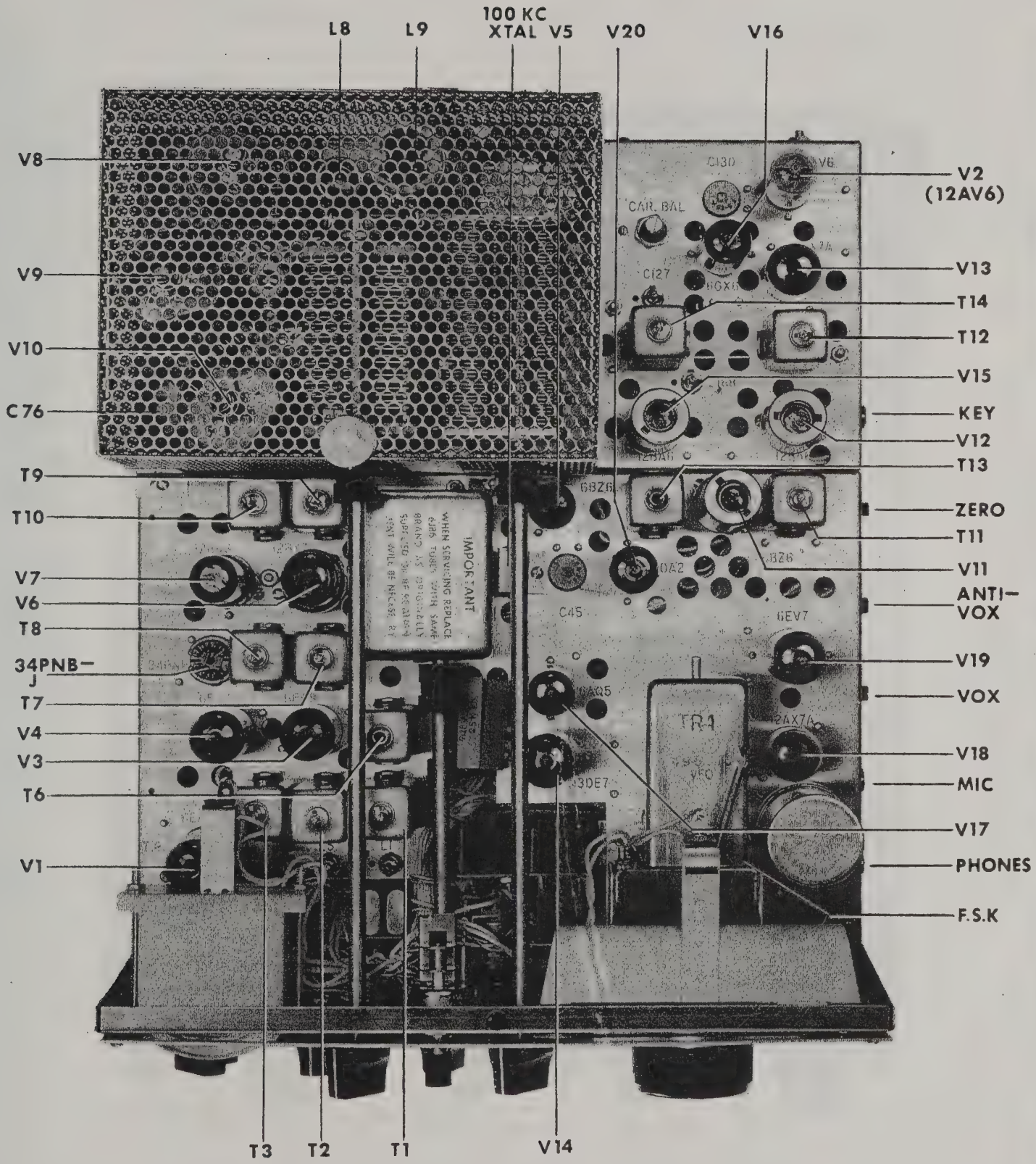


FIGURE 14. TOP VIEW

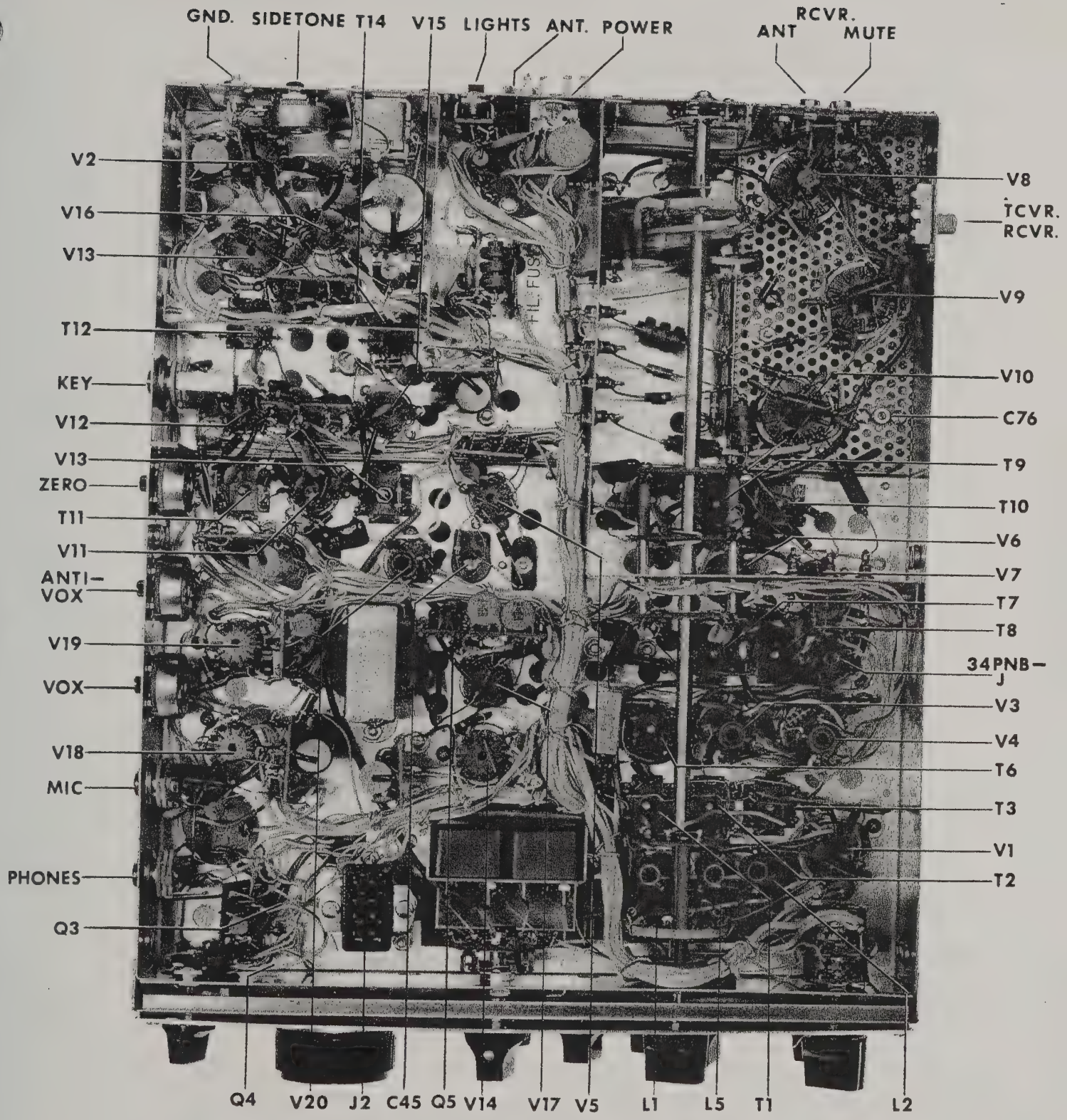


FIGURE 15. BOTTOM VIEW

VIII. ALIGNMENT INSTRUCTIONS

Alignment of the TR-4 will require the following equipment:

1. A general coverage receiver capable of receiving WWV.
2. An 11 Megohm VTVM.
3. An alignment load consisting of a 1000 Ohm non inductive resistor (1/2 Watt will do), in series with a .005 uuF disc ceramic capacitor. Small alligator clips connected to each end of this arrangement would be a great help.
4. A 52 Ohm dummy load of sufficient power handling capacity. (Heathkit Cantenna).

Before alignment is attempted, the plate and screen power leads of the final amplifier tubes should be disconnected where they pass through the partition under the chassis.

BE SURE THE POWER IS DISCONNECTED BEFORE THIS IS ATTEMPTED, OR SERIOUS ELECTRICAL SHOCK WILL RESULT.

A. CRYSTAL CALIBRATOR ALIGNMENT

1. Connect power, turn on transceiver and let warm up 30 minutes.
2. Preset the XMTR GAIN control fully counter clockwise.
3. Set FUNCTION switch to CAL.
4. Tune in WWV on the general coverage receiver with the BFO off.
5. Connect a wire from the receiver antenna terminal to V5 of the TR-4. Wrap the wire around the tube a turn or two.
6. Adjust C-45, located on top of the TR-4 chassis, until the calibrator signal is zero beat with the unmodulated WWV carrier.

B. ADJUSTMENT OF 9.0 MHz OSCILLATOR

1. Make sure that the TR-4 has had a chance to warm up for 30 minutes.
2. Set the FUNCTION switch in the SSB position.
3. Turn up the AUDIO GAIN control until noise is easily audible in the speaker.
4. While switching the SIDEBAND knob back and forth, adjust C-130, located on top of the chassis near the rear edge, until the pitch of the noise is the same on both positions.

C. CRYSTAL OSCILLATOR ALIGNMENT

1. Set the VTVM to its lowest DC negative volt scale and set pointer to about center scale with VTVM zero adjust control.
2. Connect the common lead of the VTVM to the TR-4 chassis and the DC lead to test point at V-1.
3. Set band switch to 40 meters and adjust L-1 for maximum negative DC voltage.
4. Switch to 15 meters and adjust L-5 for maximum as in Step 3.
5. Switch to 10_3 (fully clockwise) and adjust L-2 for maximum as in Steps 3 and 4.
6. The 10_1 and 10_2 bands should read about the same negative voltage as 10_3.

D. VFO ADJUSTMENT

The permeability tuned VFO was carefully adjusted at the factory and should require no further alignment. If it does not appear to track from one end of its range to the other, it should be returned to our plant for realignment. Maximum calibration error is 1 kHz when calibrated to the nearest 100 kHz point.

If you notice the same error from one end of the band to the other, and you cannot correct it with the movable dial index, the main dial may be slipped on its shaft enough to bring the corrector back into range.

E. ADJUSTMENT OF INJECTION COUPLERS

1. Tune in crystal calibrator signal at 7.3 MHz (BAND switch on 40 meters).
2. Place alignement load from Pin 6 of V-1b to ground and adjust T-3 top for maximum S-meter reading.
3. Move load to Pin 9 of V-3a and adjust T-3 bottom for maximum.
4. Move BAND switch to 15 meters and repeat the procedure for T-2.
5. Move BAND switch to the center 10 meter band and repeat the above procedure for T-1. Note: On T-1, adjust the bottom slug when the load is on Pin 6 of V-1b and the top slug when the load is on Pin 6 of V-3a.

F. RECEIVING IF ALIGNMENT

1. Peak RF TUNE control on noise at 3.8 MHz.
2. Adjust T-11 top and bottom and T-12 top and bottom for maximum noise from the speaker.

G. ADJUSTMENT OF BALANCED MODULATOR

1. Disconnect power and reconnect the screen and plate supply leads to the final amplifier tubes.
2. Reconnect power.
3. Connect dummy load to antenna jack (J-4).

> NO ATTEMPT SHOULD BE MADE TO OPERATE THE TR-4 ON TRANSMIT UNLESS IT IS CONNECTED TO AN ADEQUATE LOAD. TO DO SO COULD RESULT IN SERIOUS DAMAGE.

4. Peak RF TUNE for maximum receiver sensitivity.
5. With XMIT GAIN fully counter clockwise, place FUNCTION switch in X-CW position and SIDEBAND switch in "X" position.
6. If plate current exceeds 0.15 Amp, rotate RF TUNE until 0.15 Amp is observed.
7. If plate current is less than 0.15 Amp, rotate CARRIER BALANCE pot until plate current reaches 0.15 Amp.

> IN THE NEXT STEP, PREVENT PLATE CURRENT FROM RISING ABOVE 0.15 AMP BY DETUNING "RF TUNE".

8. Peak T-14 for maximum plate current.
9. Null CARRIER BALANCE pot (and C-127 if necessary) for minimum plate current. When properly set, there will be no difference in plate current between "X" and non "X" SIDEBAND switch positions.

H. FILTER MATCHING TRANSFORMERS

1. Adjust S-METER ZERO pot for zero S-meter deflection (S-1).
2. With SIDEBAND switch in USB, tune in the calibrator signal at 4.0 MHz for maximum S-meter reading.
3. Turn RF TUNE control until S-meter reads exactly S-5.
4. Turn the MAIN TUNING control clockwise to increase the audio frequency until the S-meter drops to S-3.
5. Adjust T-6 and T-13 for maximum S-meter reading.
6. Repeat Steps 2 through 5 for best results.
7. Center 9.0 MHz oscillator as described in Paragraph B, Section VIII.

I. CARRIER BALANCE ADJUSTMENTS

1. Turn the XMTR GAIN control fully counter clockwise, set the SIDEBAND switch to "X" and turn the FUNCTION switch to "X-CW".
2. Adjust the CARRIER BALANCE control for minimum plate current and RF output.

I. CARRIER BALANCE ADJUSTMENTS (Continued)

3. Now adjust the slug tuned capacitor (C-127) for further null.
4. Alternately adjust these two controls until no further null can be obtained.
5. Return the FUNCTION switch to the SSB position.
6. An external receiver tuned to the transmitter frequency will enable a deeper null to be obtained due to its additional sensitivity.

J. ADJUSTMENT OF MIXER AND RF COILS

1. Place BAND switch on 80 meters.
2. Set RF tune control to 5.
3. Set FUNCTION switch to CAL and tune in the calibrator signal at 3.8 MHz.
4. Adjust T-7 and T-9 bottom for maximum S-meter reading.
5. Set BAND switch to 40 and RF TUNE to 7.
6. Tune in a calibrator signal at 7.3 MHz and adjust T-8 and T-10 top for maximum S-meter reading.
7. Set BAND switch to 20 and RF TUNE to 5.
8. Tune in CAL signal at 14.2 MHz and peak T-7 and T-9 top for maximum S-meter reading.
9. Set BAND switch to the center 10 meter band and the RF TUNE control to 5.
10. Set the SIDEBAND switch to "X" and FUNCTION switch to "X-CW" (Tuning at 28.8 MHz)
11. Slowly rotate the XMTR GAIN from its counter clockwise position until a definite increase in plate current is obtained.
12. Adjust T-8 and T-10 bottom for a peak in plate current, being careful not to allow the plate current to rise above .15 Amps for more than a few seconds at a time.
13. Return FUNCTION switch to SSB.

K. FINAL AMPLIFIER NEUTRALIZING

1. Attach an RF output indicator between the TR-4 and the dummy load. If a Heath Cantenna is used, a VTVM can be attached to it for RF output indication. If no external output indicator is available, the TR-4's own RF output indicator can be used. However, this is considerably more inconvenient for this purpose.
2. Load the TR-4 on 10 meters following "Tune Up Procedure", Section IV, Part C.
3. While tuning the PLATE control back and forth through resonance, adjust C-76, using an insulated screwdriver, until the plate current dip and maximum RF output occur simultaneously.

CAUTION: THE ROTOR OF C-76 IS CONNECTED TO +250 VOLTS.

L. TRANSMITTING IF NEUTRALIZING

1. With microphone plugged into TR-4, turn VOX gain fully counter clockwise and turn XMTR GAIN fully clockwise. The FUNCTION switch should be left on SSB.
2. While talking into the microphone, increase RCVR GAIN until your speech can be heard from the speaker.
3. Adjust C-168 for minimum output from speaker.
4. If over one turn of adjustment is required, it will be necessary to realign T-14 and rebalance carrier, (See Paragraph G and I, Section VIII).

IX. AC-4 POWER SUPPLY

The R. L. Drake model AC-4 is a complete power supply capable of supplying all of the required voltages for our TR-3 and TR-4 Transceivers as well as our T-4 and T-4X/T-4XB Transmitters with the proper filtering and regulation. The unit may be operated from 120 or 240 VAC, 50 or 60 Hertz.

It is designed to fit into our MS-4 Matching Speaker or RV-4/RV-6 Remote VFO to become a single unit.

To mount it in these units, slide it in from the rear so that the line cord and power cable face outward. Fasten it in place with the four studded rubber feet provided with the unit.

To connect, plug the female power connector on the end of the power cable into the male connector on the rear of the TR-3, TR-4, T-4, T-4X, or T-4XB. (See nstallation instructions for the appropriate equipment). A 6" lead terminated in a female phono plug extends from the power connector for connecting the MS-4 Speaker when the unit is used with our TR-3 or TR-4 Transceivers.

The bias adjustment should be set properly before any operation is attempted. (See TUNING PROCEDURE, Section IV).

IMPORTANT: Never ship the AC-4 mounted inside the MS-4 Speaker or RV-4/RV-6 case or serious damage to the case will result.

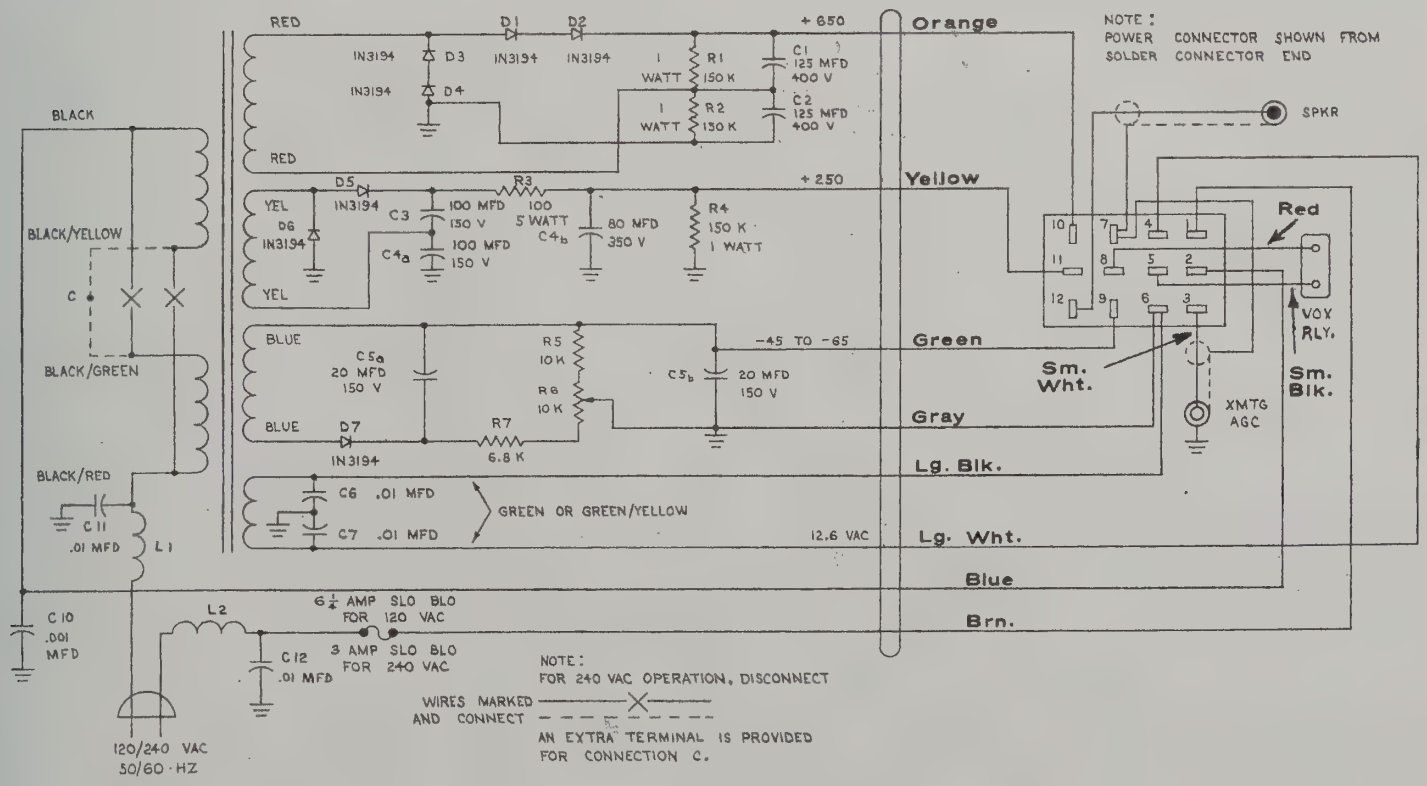


FIGURE 16. AC-4 POWER SUPPLY SCHEMATIC DIAGRAM

X. DC-4 POWER SUPPLY

A. GENERAL DESCRIPTION

The R. L. Drake model DC-4 Power Supply is a self-contained power converter which transforms 12 V DC to the voltage necessary to operate our TR-4 , T-4XB, or T-4B. A receptacle supplying 115 V AC permits operation of the R-4B/T-4XB or T-4B combination.

B. SPECIFICATIONS

Input:	12 V DC
Output:	650 V DC at 300 mA average (500 mA peak) 250 V DC at 175 mA -45 to -65 V DC adjustable bias into 33 K ohms 115 V AC at 600 mA for receiver operation * (115 V AC at 1.3 A if used alone)
Frequency:	Approximately 330 Hertz square wave
Size:	8-1/2" Long, 4-1/4" Wide , 3-1/2" High
Weight:	7 pounds

* An ON-OFF switch to short Pins 1 and 2 of the S-312 CCE female connector should be used to provide 115 V AC output for applications other than an R-4B Receiver. A "Tube Saver" such as GC Electronics No.25-898 may be required for loads other than an R-4B. This is due to the extremely low cold resistance of some loads such as incandescent lamps, some TV sets, et cetera.

C. INSTALLATION

The DC-4 is supplied for use in cars with negative ground system.

DO NOT USE WITH POSITIVE GROUND SYSTEMS OR SERIOUS DAMAGE MAY RESULT.

We recommend that the DC-4 be mounted on the passenger side of the fire wall. It should not be placed in the trunk or in the engine compartment unless it is protected from water and engine heat.

Attach the short black wire of the cable assembly to the nearest convenient ground and run the red/white wire through the fire wall to the ungrounded terminal of the battery, or the "hot" terminal of the starter solenoid. Mount the fuse

C. INSTALLATION (Continued)

holder in a convenient location as near the battery as possible. Cut the black and red/white wires as short as possible to avoid unnecessary voltage drop.

Connect the DC-4 Power Supply to the transmitter using the cable assembly supplied. Coil up any excess cable and tape it in a convenient location.

Adjust the BIAS ADJ control, located on the end of the unit, as described in the transmitter instructions under TUNING PROCEDURE, Section IV.

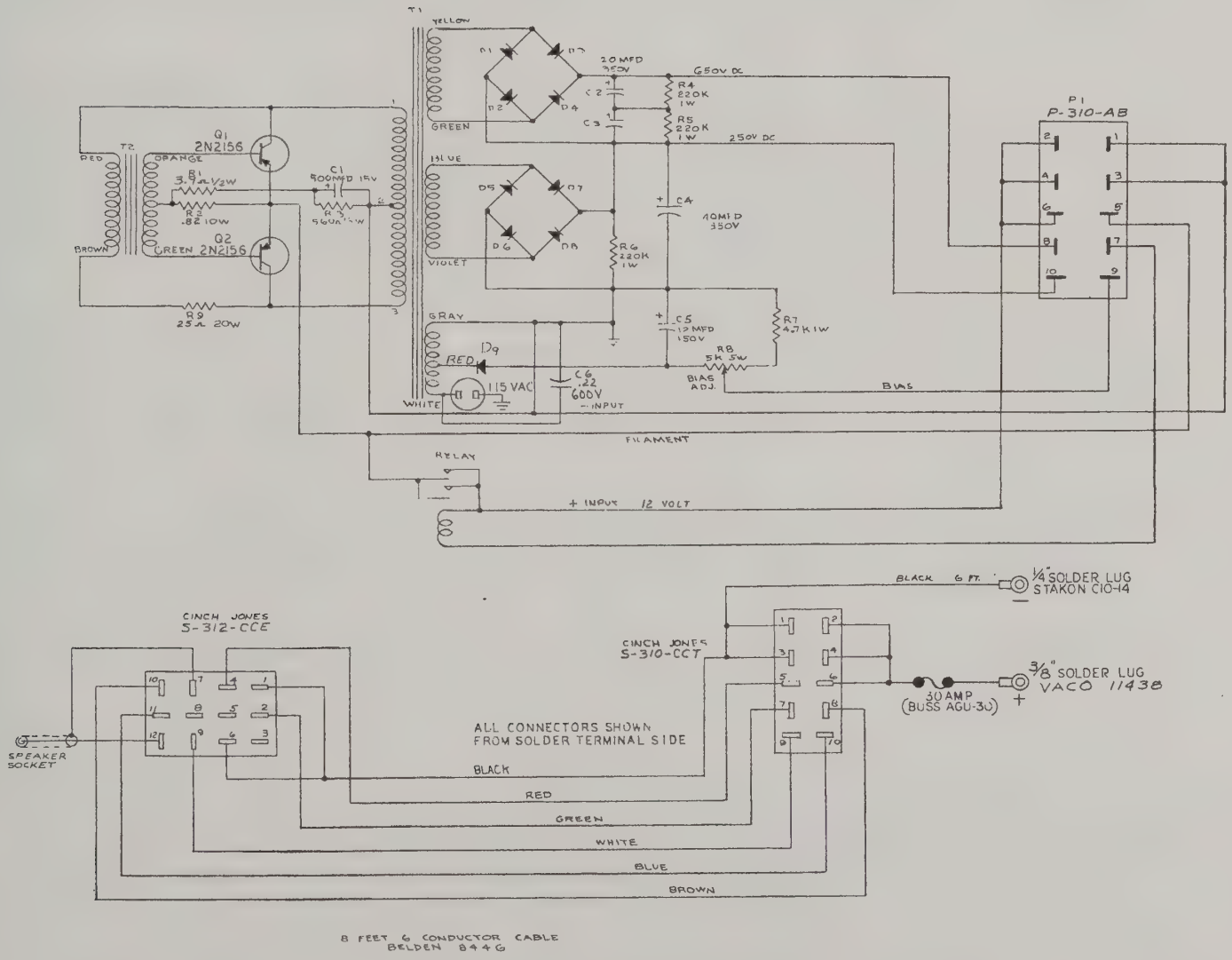


FIGURE 17. DC-4 POWER SUPPLY SCHEMATIC

XI. RV-4 REMOTE VFO INSTRUCTIONS

NOTE: If the old RV-3 is used with the TR-4, it must be modified as follows: Install a 22 K, 2 Watt resistor from Pin 1 of the OA2 to the terminal of the FUNCTION switch to which the Orange wire is attached.

The RV-4 is designed for use with the TR-3 or TR-4 Transceiver to permit reception, transmission, or both transmission and reception on a frequency removed from the VFO setting of the transceiver, but in the same band to which the transceiver is tuned. The RV-4 consists of a highly stable permeability tuned VFO, now employing an FET in its solid state design, a cathode follower and associated control circuitry.

The unit is housed in an attractive cabinet which matches the transceiver and contains a 5-inch 4 ohm speaker. Our model AC-4 (or AC-3) power supply can also be housed in this cabinet. (See AC-4 instructions.) The dimensions are as follows: 5-3/8" high, 10-3/4" wide and 11-1/8" deep. Weight 6-1/2 pounds.

INSTALLATION

To install the RV-4 with our TR-3, it will first be necessary to remove the bottom cover of the TR-3 and remove the jumper wire between Pins 2 and 8 of the RV-3 jack (J2). Now replace the bottom cover of the TR-3 and connect the RV-4 cable to J2. Connect the speaker lead to the 6-inch lead protruding from the AC-3 or DC-3 (AC-4 or DC-4) power cable connector. This completes the installation.

If it is desired to disconnect the RV-4 from the TR-3, it will be necessary to replace the RV-4 cable connector with a jumper plug. This plug should consist of an 8 conductor male plug (Cinch Jones Type P-308 with either the CCE, FHE, FHT, or CCT metal caps - remove cable clamps) with a jumper wire connected between Pins 2 and 8.

For use with the TR-4, it is necessary only to plug the RV-4 into the RV-4 plug J2 on the bottom of the TR-4 chassis. No jumper need be removed when the unit is installed nor is a jumper plug needed when it is disconnected.

NOTE: It is necessary to bond RV-4 chassis to transceiver chassis and to a good ground with a short piece of braid.

OPERATION

The RV-4 has two controls: The MAIN TUNING and the RV-4 FUNCTION switch. The MAIN TUNING control determines the frequency of the VFO and is calibrated in exactly the same way as the transceiver VFO. The RV-4 FUNCTION control has four positions: OFF, RCV, RCV/XMIT, and XMIT.

In the OFF position, the unit draws B+ and filament current but does not provide any output. The transceiver will transceive normally.

OPERATION (Continued)

In the RCV position, the RV-4 determines the receiving frequency and the transceiver VFO determines the transmitting frequency.

In the RCV/XMIT position, both transmit and receive frequencies are determined by the RV-4.

In the XMIT position, the RV-4 determines the transmitting frequency and transceiver VFO determines the receiving frequency.

The PTO indicator lamp is located directly above the MAIN TUNING knob. This lamp lights whenever the RV-4 is being used to control the frequency.

SERVICE DATA

We will check and factory align your RV-4 for a nominal fee of $5.00 plus transportation charges if the set has not been tampered with. If the repairs are necessary, we will advise you of the cost before proceeding with the work. Units that have been tampered with or misaligned will be repaired on a time and material basis.

A. REMOVAL FROM CABINET

1. If the AC-4 (or AC-3) power supply is installed in the RV-4 cabinet, it will first be necessary to remove it by removing the four screws holding it to the bottom of the RV-4 cabinet and sliding it out the rear.

2. Now loosen the six screws holding the RV-4 in the cabinet and slide it out the rear.

B. TUBE REPLACEMENT

In general, most trouble encountered in radio equipment of good design is due to tube failure. The RV-4 has been designed so that tube replacement can be done without need for realignment. The best method of finding defective tubes is direct substitution. It is best not to rely too heavily on tube checkers.

C. TROUBLESHOOTING

Careful consideration has been given in the design of the RV-4 to keep maintenance problems to a minimum. However, it is quite possible that some problem will arise which cannot be cured by tube substitution. If this occurs, we suggest that you either return your unit to your dealer or write direct to our Customer Service Department describing your problem in detail. Include full information concerning external connections, control settings, tube substitution, et cetera. Do not return equipment to the factory without prior authorization.

C. TROUBLESHOOTING (Continued)

The voltage and resistance charts and the schematic diagram should be valuable in isolating minor problems. However, no attempt should be made to service the RV-4 unless you are thoroughly familiar with electronic circuitry and servicing technique.

D. ALIGNMENT

The RV-4 is very carefully aligned at our factory and should require no further adjustment. If a tracking error in the VFO is noted, the unit should be returned to our factory.

However, if the unit has the same calibration error from one end of the dial to the other, and if the error cannot be corrected by the movable index line, the dial scale can be slipped slightly on its shaft until the discrepancy is eliminated.

The only adjustment in the RV-4 which should require any readjustment is coil L2. This coil is mounted inside the small aluminum can on the RV-4 chassis. To adjust proceed as follows:

1. Switch the RV-4 FUNCTION switch to RCV and tune its VFO to the 4.0 MHz crystal calibrator signal (Transceiver FUNCTION switch should be on CAL and BAND switch on 80.)

2. Tune L2 for maximum S-meter reading. This completes the adjustment.

   Note that coil L3 has a value determined by the length of the cable connecting the RV-4 to the transceiver. Do not change the cable length or misalignment will result.

VOLTAGE CHART

Pin	1	2	3	4	5	6	7	8	9
V1	170	0	42	12.6*	0	170	0	4.2	6.3*

NOTE: These measurements were made from ground with an 11 Megohm VTVM. The RV-4 was connected to the transceiver which was in the receive condition. The RV-4 FUNCTION switch was on the RCV/XMIT position. An * indicates AC voltage.

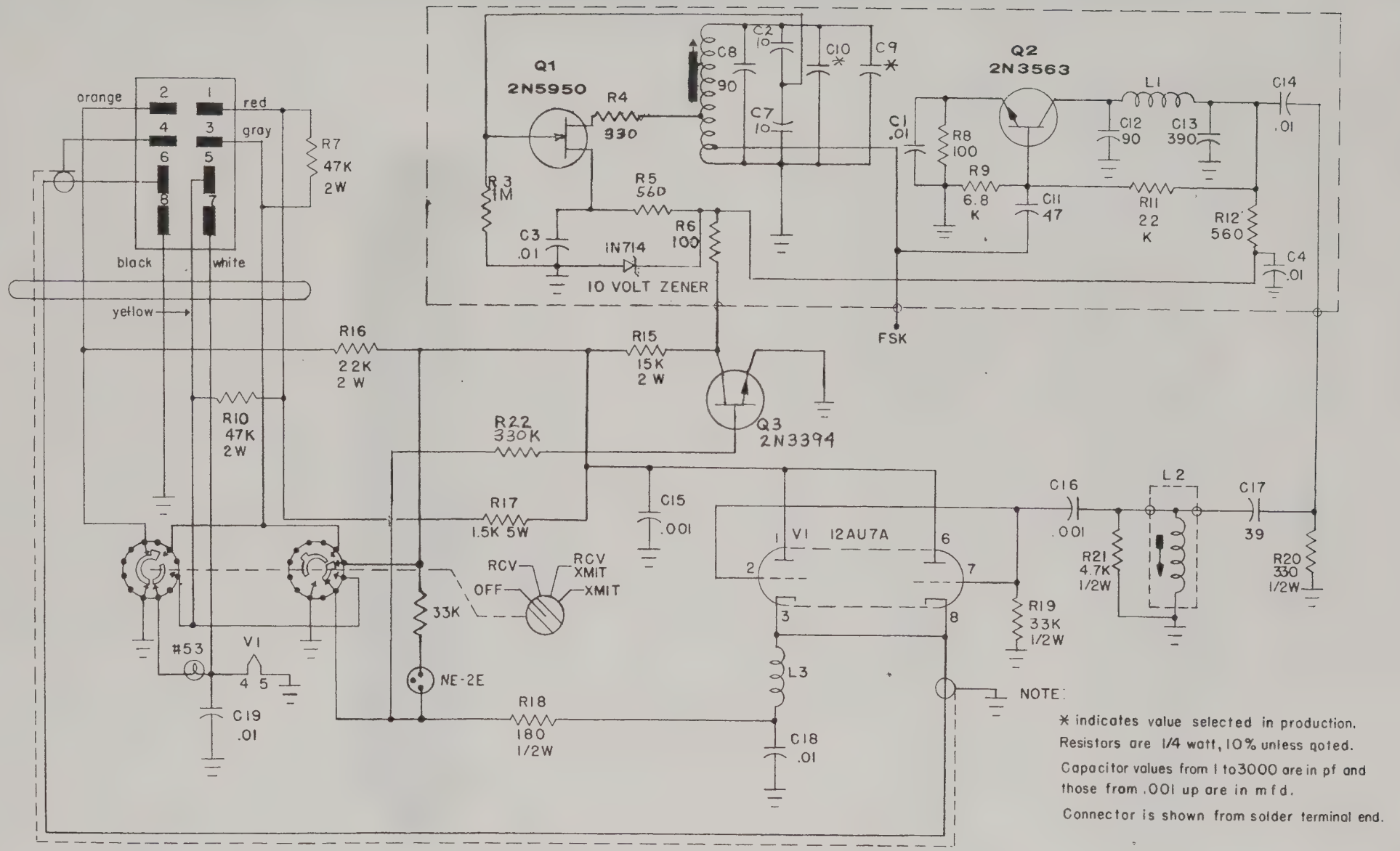
RESISTANCE CHART

Pin	1	2	3	4	5	6	7	8	9
V1	11K 8K	33K	180	0	0	11K 8K	33K	180	0

D. ALIGNMENT (Continued)

RESISTANCE CHART (Continued)

NOTE: These measurements were made from ground with the RV-4 connected to the transceiver but with the transceiver disconnected from the power supply. Where two resistances are shown, the top value was obtained with the RV-4 connected to the TR-3 and the bottom value was obtained with the unit connected to the TR-4. The RV-4 FUNCTION switch was in the RCV/XMIT position.



SCHEMATIC DIAGRAM MODEL RV-4 REMOTE VFO

FIGURE 18

XII. FF-1 FIXED FREQUENCY ADAPTER

A. DESCRIPTION

The Model FF-1 Fixed Frequency Adapter is a solid state frequency determining unit. It provides crystal control of any two operating frequencies falling within the normal operating range of the TR-4 Transceiver. The FF-1 is well suited for net operation since it provides crystal controlled transmit frequency with VFO controlled receive frequency or crystal controlled transmit and receive frequency.

B. OPERATION

With the FF-1 in the OFF position, the TR-4 functions normally. In the "T" position, the transmit frequency is crystal controlled while the receive frequency is controlled by the VFO. In "T/R" position, transmit and receive frequencies are crystal controlled. In all cases, the red indicator lamp lights whenever the FF-1 is activated.

Two switch selected frequency channels are provided.

FF-1 MOUNTED UNDER TR-4

FIG.# 19

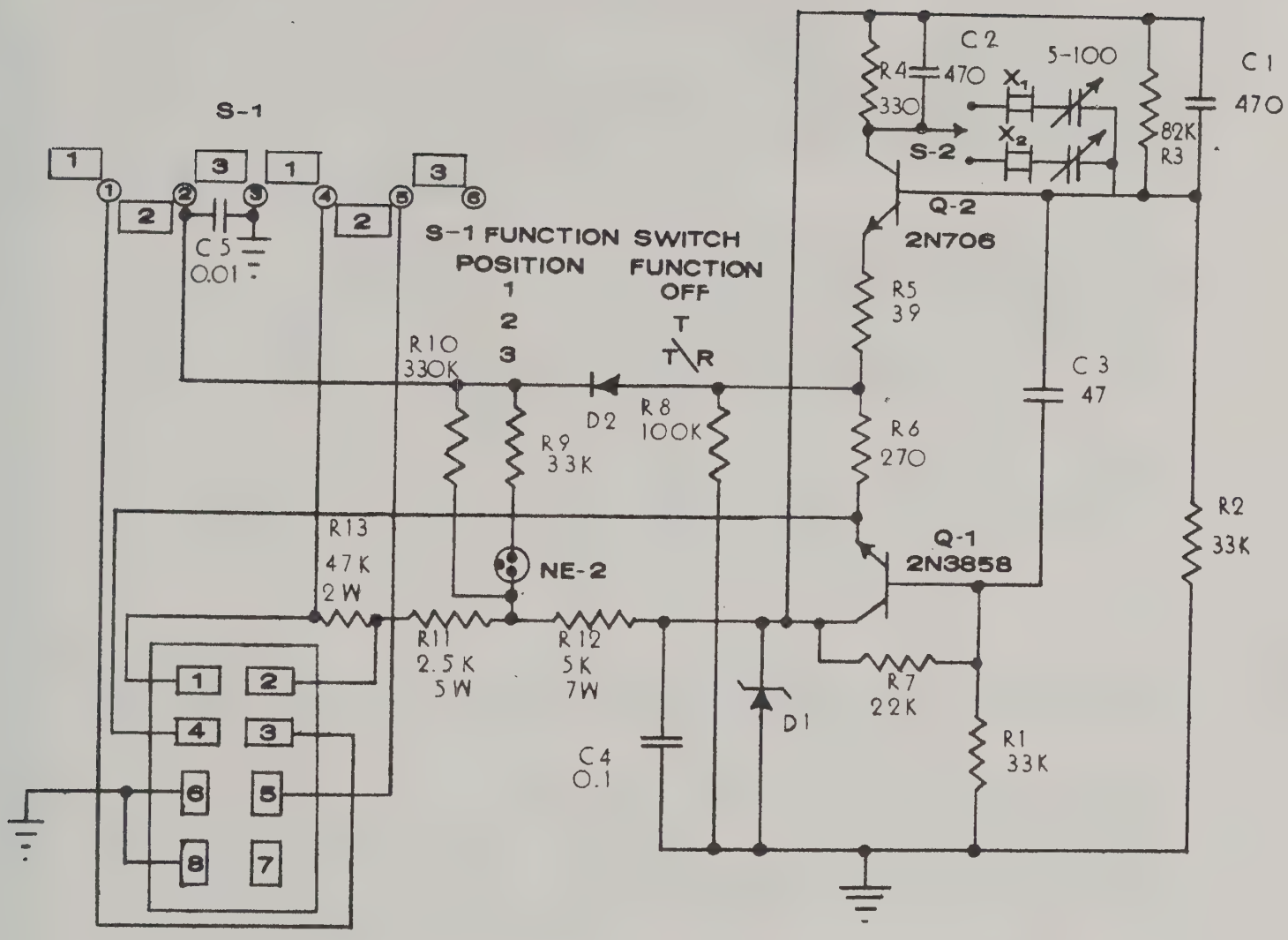


FIGURE 20. FF-1 FIXED FREQUENCY ADAPTER SCHEMATIC

XIII. 34-PNB PLUG IN NOISE BLANKER

A. GENERAL DESCRIPTION

This noise blanker is a solid state noise blanker.

Unlike noise clippers or limiters commonly found in communications equipment, this is an advanced noise blanker which actually mutes the receiver for the duration of the noise pulse. Between noise pulses full receiver gain is restored. (The receiver AGC is affected only by the desired signal strength, not by the noise at the antenna.)

This blanker is most effective on strong, periodic noise impulses such as ignition noise. The blanker is least effective on random noise (e.g. atmospheric or front end noise). This noise is continuous in time and the information it masks cannot be recovered by either blanking or limiting techniques. However, loss of communications due to random noise is a rare occurrence - generally impulse noise is responsible for such situations.

Low level signals masked by noise impulses without the noise blanker can be copied when the blanker is used. Noise blanking is a must for the mobile operator because he can now blank ignition noise due to trucks and other cars as well as his own car.

B. OPERATION

The noise blanker functions when the blanker switch is in the ON position. When transmitting, the position of the switch is unimportant.

In most situations, it is desirable to leave the blanker on continuously. However, it may happen you are copying an extremely weak signal under no noise conditions. In this situation, it may be advantageous to turn the blanker off since occasional peaks of atmospheric noise may trigger the blanker and generate additional noise.

C. INSTALLATION

Remove the power socket from back of the TR-4. Remove the top half of the TR-4 cabinet. Remove the 7 pin jumper plug located near the front of the power amplifier cage.

With the circuit side of the 34-PNB toward the side of the TR-4, carefully plug in the 34-PNB. After the 34-PNB is correctly seated in the socket, install the two #4 self taping screws in each corner of the 34-PNB bracket to secure it to the TR-4 chassis. Replace the cabinet top and screws and the blanker is now ready to use.

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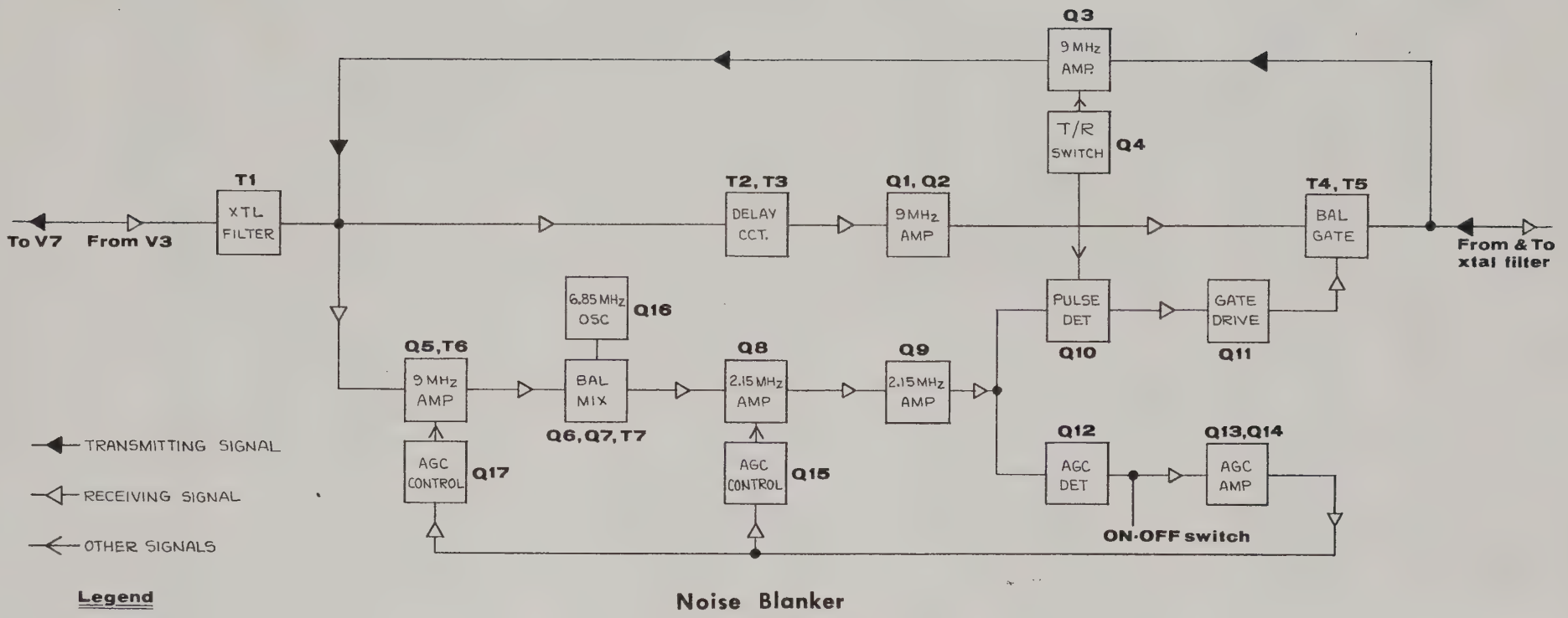


Noise Blanker

Fig. 22 Block Diagram

D. DESCRIPTION

This noise blanker system can be broken down into three major parts for the purpose of discussion.

The first part - the transmitting path - is the simplest. It consists of a single RC coupled 9 MHz amplifier which passes the transmit signal through the blanker as well as making up for any loss in the matching networks. The signal then passes through the crystal filter passband and into the transmit mixer.

The second part is the receiver path. Referring to the block diagram the signal first passes through a crystal filter with a bandwidth wide enough to pass most of the noise frequency components but narrow enough to keep strong adjacent signals from overloading the noise blanker amplifier. The signal simultaneously enters the noise processor (discussed later) and the delay circuit, a reactive network which compensates for the inherent phase shift of the noise processing section. The 9 MHz receive amplifier provides an overall system gain for the receive path. The balanced gate is a noiseless electronic series switch that opens for noise pulses but closes to allow the signal to pass.

The third part is the noise processor and the most complicated of all. The signal passes through the tuned 9 MHz amplifier and into the balanced mixer. This mixer converts the 9 MHz noise pulses to 2150 kHz and prevents the high level 6.85 MHz oscillator signal from reaching the amplifier strip. The 2150 kHz noise pulses travel through the two amplifiers, detector, and into the gate driver. The driver reverse biases the gate at the instant a 9 MHz noise pulse enters on its way to the receiver IF. The gate then is controlled by the same pulse it is blanking, enabling it to automatically respond to pulses of varying width.

If the noise blanker had been installed in the receiver IF strip near the detector, much circuitry could have been eliminated. The disadvantage to this shortcut method is deterioration in the noise performance due primarily to filter ringing. In other words, the noise pulse would encounter the non-linear phase response of the high "Q" crystal lattice filter and lengthen, masking more of the desired signal. The narrow crystal lattice filter would also remove the high frequency components of the noise pulse, thus reducing its rise time. The noise pulse is now highly distorted and the noise blanker has difficulty separating the pulse from the desired signal.

Although more expensive, we decided not to cut corners and designed the system for maximum noise performance - something the mobile operator especially will appreciate.

E. ALIGNMENT

1. T-6 Filter Match

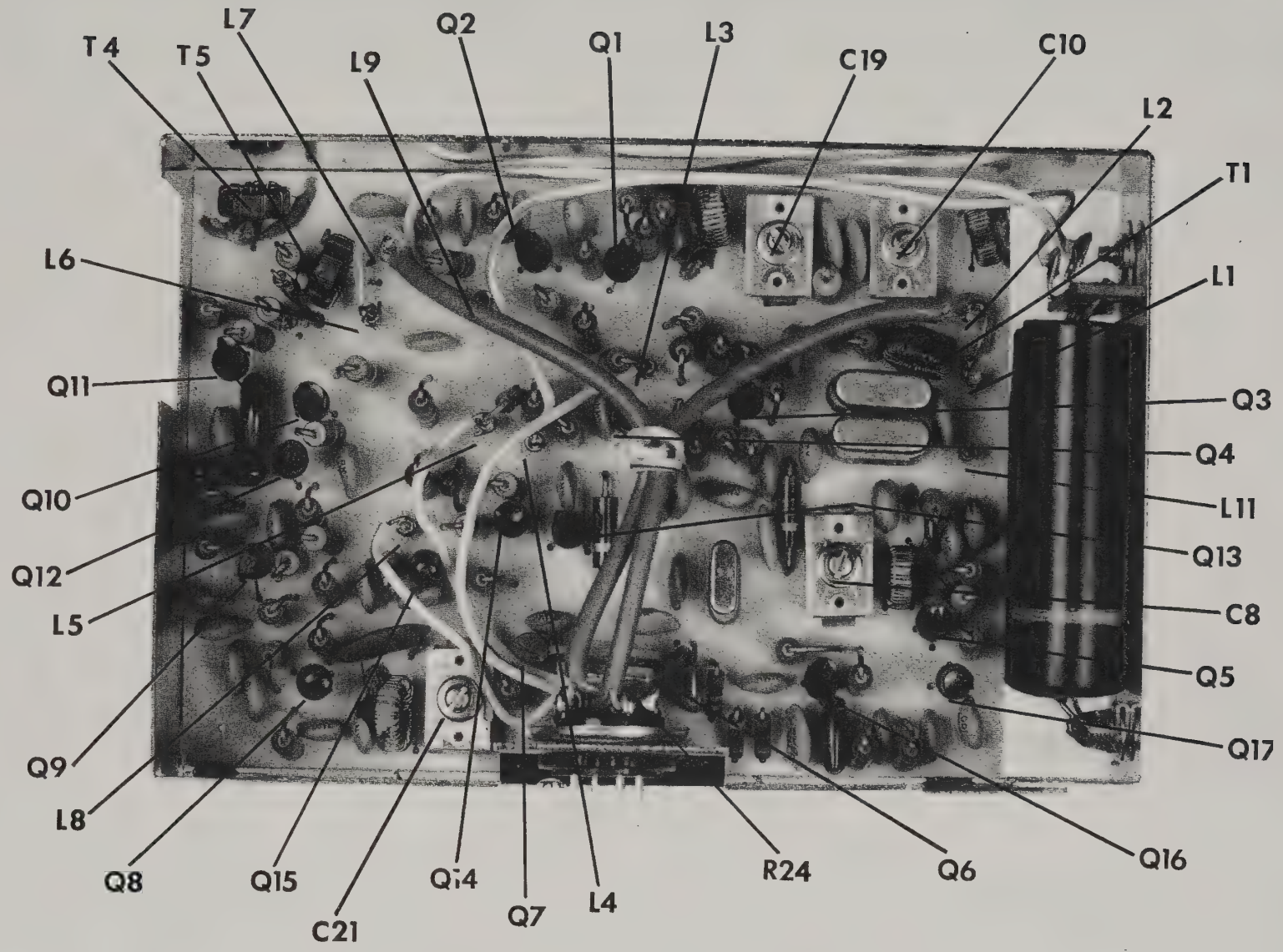
Refer to Section VIII, Paragraph H (Filter Matching Transformer) of TR-4 Alignment Instructions.

2. 9-NB Board Alignment

a. With the noise blanker turned on, adjust capacitor trimmers C_{10} and C_{19} for maximum S-meter reading on calibrator signal. (See Figure 22)

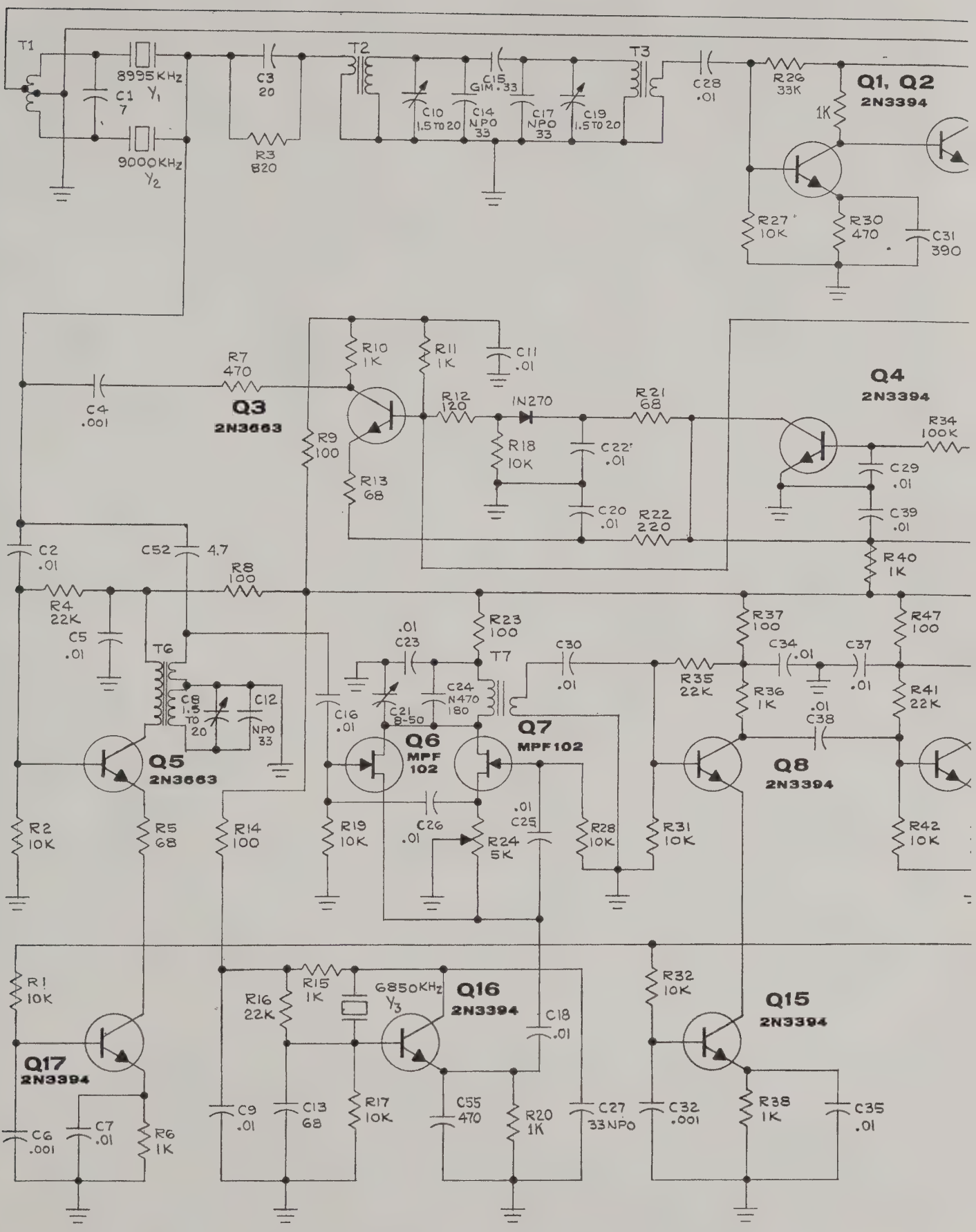
b. With the calibrator turned off, connect a VTVM (set to measure DC voltage) to terminal 8 of the 9-NB board and ground (terminal 8 being plus). Adjust R-24 for maximum positive voltage. (See Figure 22).

c. Turn the calibrator on and adjust the two remaining trimmers (C-21 and C-8) for minimum positive voltage. (See Figure 22).



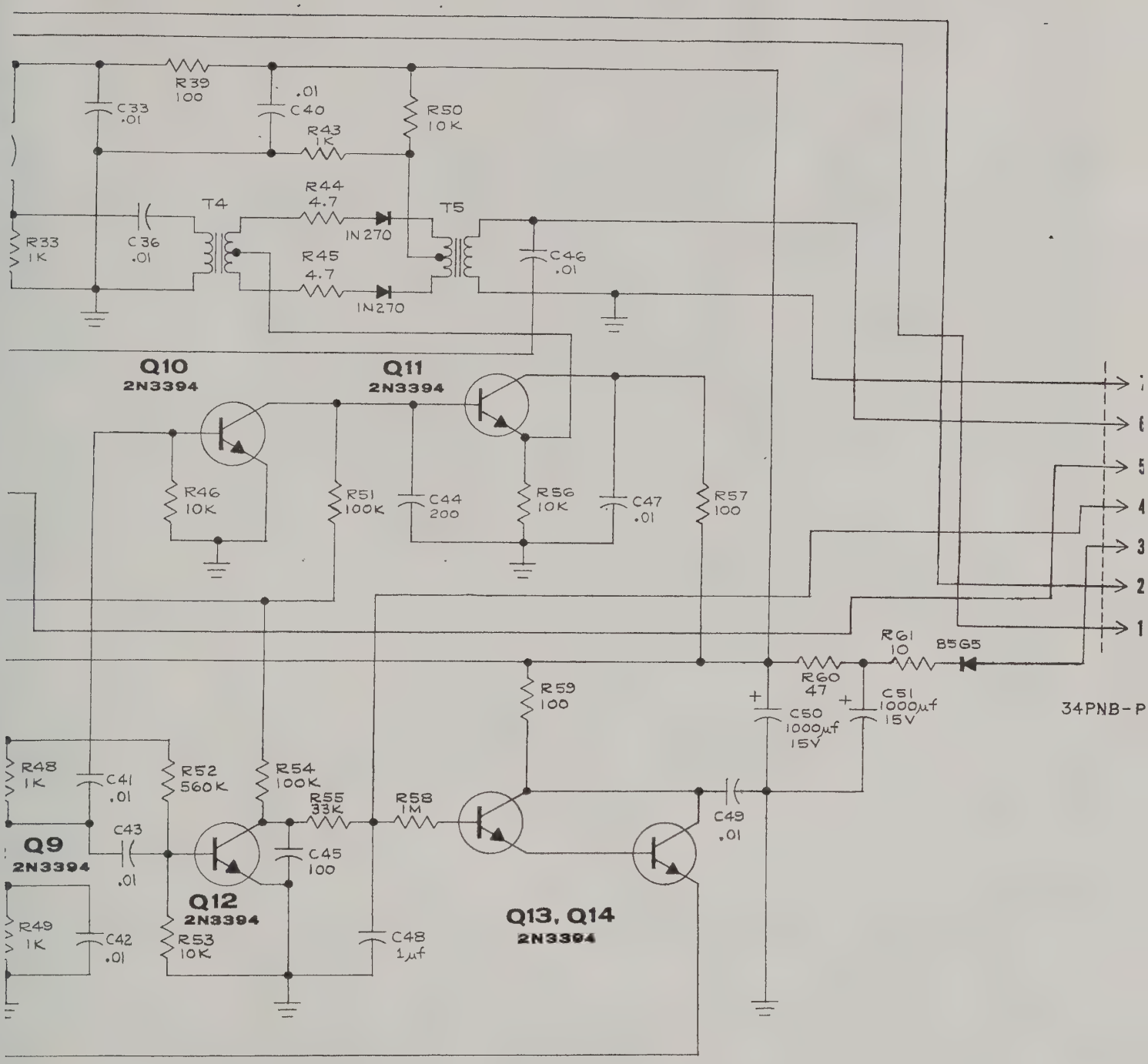
CIRCUIT BOARD LAYOUT 34-PNB

FIGURE 23



34PNB Noise Bla

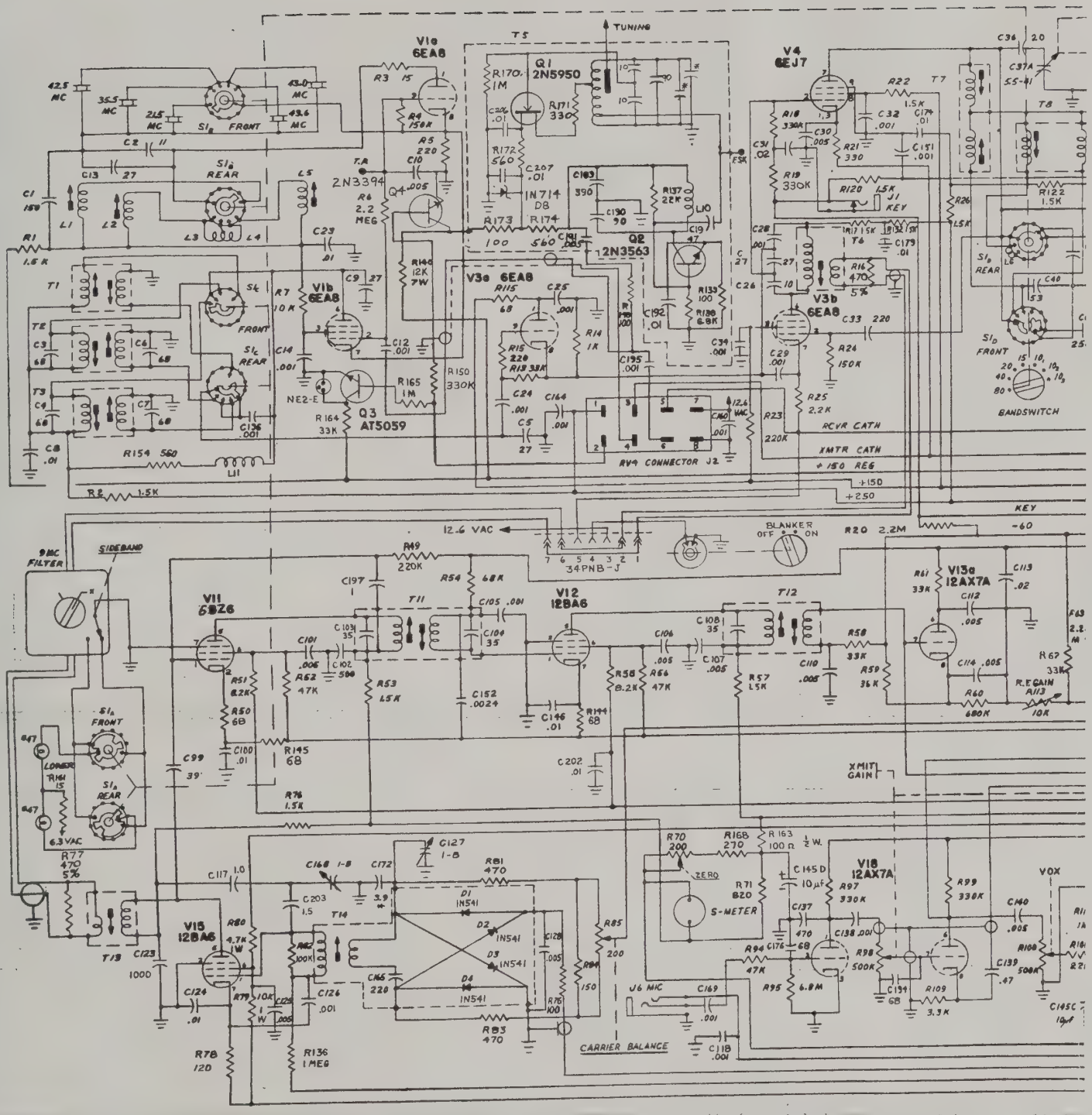
FIG. 24



NOTE:

1.) ALL CAPACITORS IN pf EXCEPT .001µf, .01µf

nker Schematic



BAND, FUNCTION, and BLANKER switches viewed in counter clockwise position.
All resistors in VFO assembly T-5 are 1/4 watt.
All other resistors are 1/2 watt 10%, except where noted.
Capacitor values from 1 to 1000 are in pF and those from .001 are in mfd unless otherwise noted.

J_2 and J_3 shown outside view.

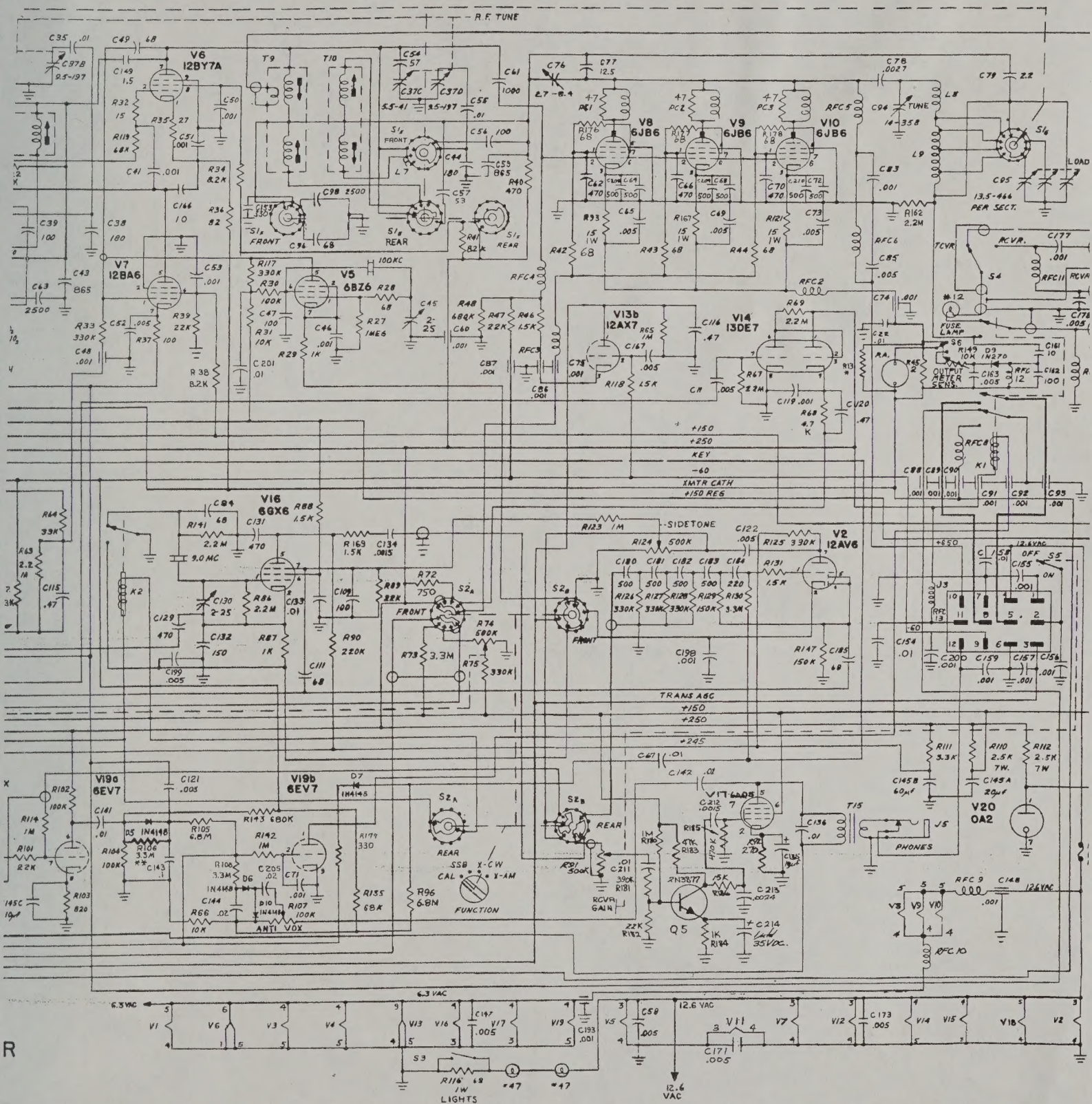
Highest resistor R186
Highest capacitor C214

* Value selected in production.
** Adjust to change VOX holding time.
*** Filament fuse is a 1-1/2" length of #26 tinned copper wire.

SCHEMATIC DIAGRAM
MODEL TR-4 TRANSCEIVER

811-1030500

FIGURE 21


R.F. TUNE
V6 12BY7A
V7 12BA6
V5 6BZ6
V8 6JB6
V9 6JB6
V10 6JB6
V13b 12AX7
V14 13DE7
V16 6GX6
V2 12AV6
V19a 6EV7
V19b 6EV7
V17 6AQ5
V20 0A2
Q5 2N3877
TUNE
LOAD
13.5-466 PER SECT.
RCVR.
XMTR
FUSE LAMP
OUTPUT METER SENS.
+150
+250
KEY
-60
XMTR CATH
+150 REG
SIDETONE
TRANS AGC
+245
+650
12.6VAC
OFF
ON
PHONES
9.0 MC
FRONT
REAR
SSB X-CW
CAL X-AM
FUNCTION
ANTI VOX
RCVR GAIN
LIGHTS
6.3 VAC
12.6 VAC

TR-4C INSTRUCTION MANUAL

ERRATA SHEET

Figure 5-5, TR-4C Schematic, Page 5-11.

C190 is an 80pF instead of 68pF (PTO).

R59 is a 43K instead of 36K.

R164 is a 47K instead of 33K.

The 90pF capacitor across PTO tuning coil is two 45pF tubulars in parallel.

The VFO lamp is an NE2H instead of NE2E.

C221 is a 68pF instead of 62pF.

Add C223, .01uF on 12.6 VAC line off 34PNB receptacle to ground.

Add C224, .01uF on +235V line off "S" meter to ground.

Add C225, .001uF between V2, pin 2 and S2B(F).

Add C226, 1.5pF in parallel with C76 and C77.

R101 is an 82K instead of 22K.

R135 is a 33K instead of 68K.

R143 is a 330K instead of 680K.

R190 is a 2.2M instead of 22M.

Add R194, 1.5K in series with plate of relay tube V19B and relay K1 (delete C92).

K1 is a 2.5K relay instead of 15K.

V19 is a 6FQ7 instead of 6EV7 (see pages 4-4; 5-3; 5-4; 5-7).

Page 5-3.

Table 5-1. RESISTANCE CHART, should read: V19; 6FQ7; pin 1 thru 9; 12K; 4.5 Meg; 0; Fil; 0; 100K; 620K; 820; 1.6 Meg.

Page 5-4.

Table 5-2. VOLTAGE CHART, should read: V19; 6FQ7; pin 1 thru 9; 240/165; -9.5/0; 0; 6.3*; 0; 67/87; 0; 1.5/1.27; TP.